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DEPARTMENT OF THE ARMY FIELD MANUAL

RIVER-CROSSING OPERATIONS

HEADQUARTERS, DEPARTMENT OF THE ARMY

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RIVER-CROSSING OPERATIONS

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*This manual supersedes FM 31-60, 12 November 1958.

GENERAL

CHAPTER 1

Section I. INTRODUCTION

1. Purpose

This manual furnishes guidance in planning and executing tactical river-crossing operations. A list of supplemental references appears in appendix I.

2. Scope

a. This manual is applicable to all forms of warfare. Modifying guidance for nuclear warfare is integrated.

b. Crossings of opportunity are a product of routine offensive operations. River-crossing operations discussed herein are those nonroutine offensive operations required when crossings of opportunity fail to materialize.

c. Appendix II contains data on crossing equipment.

d. Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Changes should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded direct to U.S. Army Command and General Staff College, Fort Leavenworth, Kans.

3. Operational Environment

a. River-crossing operations may be required in any environment and under any level of nuclear weapon usage which permits ground maneuver.

b. Under conditions of active nuclear warfare the crossing of a river generally requires forces and tactics designed to capitalize on the effects of friendly nuclear fires. Crossing forces exploit friendly nuclear fires to seize and secure crossings before the enemy can react.

c. A crossing operation normally is conducted by a division as part of a corps operation. The division usually requires higher echelon support such as crossing equipment, engineer troops, smoke generator units, military police, aircraft, and artillery.

Section II. EXPLANATION OF TERMS

4. Types of River Crossing Operations

a. A *hasty crossing* is a planned river crossing operation conducted with minimum loss of momentum by assault forces. Fire support and crossing means are made available to assault force commanders on arrival at the river. Speed, surprise, and decentralization of control of specific crossing times of subordinate assault forces characterize a hasty river crossing.

b. A *deliberate crossing* is a planned river-crossing operation which requires a buildup of the required force and crossing means to overcome the barrier and enemy defense of the far shore. The enemy is cleared from the near shore prior to the attack. Detailed plans and preparations are made for a coordinated assault on the far shore.

5. Crossing Front

A *crossing front* is the length of the river line in a unit's zone of action.

6. Crossing Sites

Crossing sites are the locations where bridge, raft, and assault crossings can be made within a crossing front (fig. 1).

7. Crossing Area

A *crossing area* is that portion along a river which contains bridge and raft sites, the assault crossing sites required to secure the bridge and raft sites, and the surrounding terrain which is subject to the effects of enemy fires concentrated on the crossing sites. The radius of damage for the largest enemy tactical nuclear weapon is considered when determining the depth to which the crossing area extends on both sides of the river (fig. 1). For further details see paragraphs 60*f* and 62*b*.

8. Bridgehead

A *bridgehead* is the area on the hostile side of the river which is seized and secured by the assault force. The area should accommodate and facilitate maneuver of the forces involved in the crossing without congestion, provide protection for the crossing of the remainder of the force, and provide a base for further operations.

Section III. BASIC CONSIDERATIONS

9. Purpose of Crossing Operations

The purpose is to establish a bridgehead on the far side to pro-

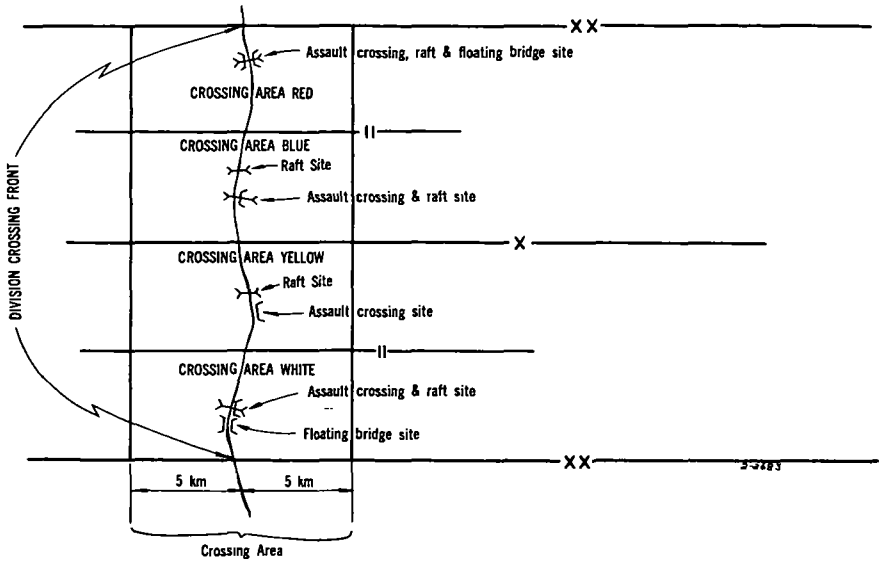

Figure 1. Schematic sketch of a division in a river crossing.

tect the crossing of the remainder of the command to resume normal offensive operations.

10. Broad Aspects of Operations

A river-crossing operation includes—

a. Advance to the river.

b. Final preparation for crossing.

c. The assault.

d. Advance on the enemy side of the river.

e. Establishment of the bridgehead.

f. Protection of the bridgehead against counterattack.

CHAPTER 2
INTELLIGENCE

11. General

a. Complete, timely, and accurate intelligence enables a commander to better devise a workable river-crossing plan.

b. Both combat and strategic intelligence is used in the initial planning at corps and higher level.

c. The development of intelligence prior to and during the planning period is emphasized.

12. General Intelligence

a. Data produced by strategic intelligence agencies are furnished to lower echelons before and during the advance to the river. Emphasis is placed on information needed by engineers to solve the technical problems of rafting and bridging operations. See appendix IV for an outline of the intelligence annex.

b. Intelligence is produced on the following:

(1) *Capabilities of enemy to oppose the crossing,* to include tactics, nuclear and CBR capability, availability and effectiveness of air support, and his courses of action during and after the establishment of a bridgehead.

(2) *River characteristics,* to include width and depth of the stream; its fordability by troops and vehicles, velocity and character of the current including crosscurrents, undertow, and tidal flow, if any; the height, slope, and condition of the banks; the condition of the river bed; the gradient in the direction of flow; location of dams and other manmade structures and their effect on the stream characteristics; flood and ice conditions.

(3) *Natural and manmade obstacles,* to include data on their location and extent and their possible effect on movement of both foot troops and vehicles.

(4) *Tactical effect of weather and terrain,* to include the terrain on both sides of the river; information concerning areas for assembly and dispersal; cover and concealment near the crossing sites; best avenues of approach to the river and to objectives on the far side; positions for supporting weapons, observation posts, and combat service support installations; enemy defensive use of the terrain; terrain objectives; space for maneuver and reorganization by our own troops. Information on weather includes the effects of precipitation on extremes of

trafficability; effect of precipitation in the watershed of the river on the depth, width, and current of the river; restrictions on visibility caused by weather factors; effect of wind speed and direction and precipitation on the use of smoke and incendiaries; weather factors that may affect the employment of nuclear fires, CBR agents, or air support; other information on features of the weather which may favorably or unfavorably affect river crossing operations. See FM 30–10.

(5) *Road nets and approaches,* to include width, surface, and capacity of roads; road and rail nets to and from the crossing sites; and data regarding routes of advance beyond the projected bridgehead.

(6) *Crossing sites,* to include details on the location and characteristics of each.

(7) *Local resources in the area,* to include information on available structural steel, hardware, sand, gravel, boats, barges, ferries, local labor, timber, and lumber.

13. Special Intelligence Report

A special intelligence report for the river crossing includes all information and intelligence pertinent to the final plan for the operation. This report may be written and as such normally is an annex to the intelligence summary or periodic intelligence report. The report may be in the form of a special map (fig. 2) which shows essential information such as existing bridge sites stream data, enemy dispositions and installations, obstacles, road nets, and other pertinent data.

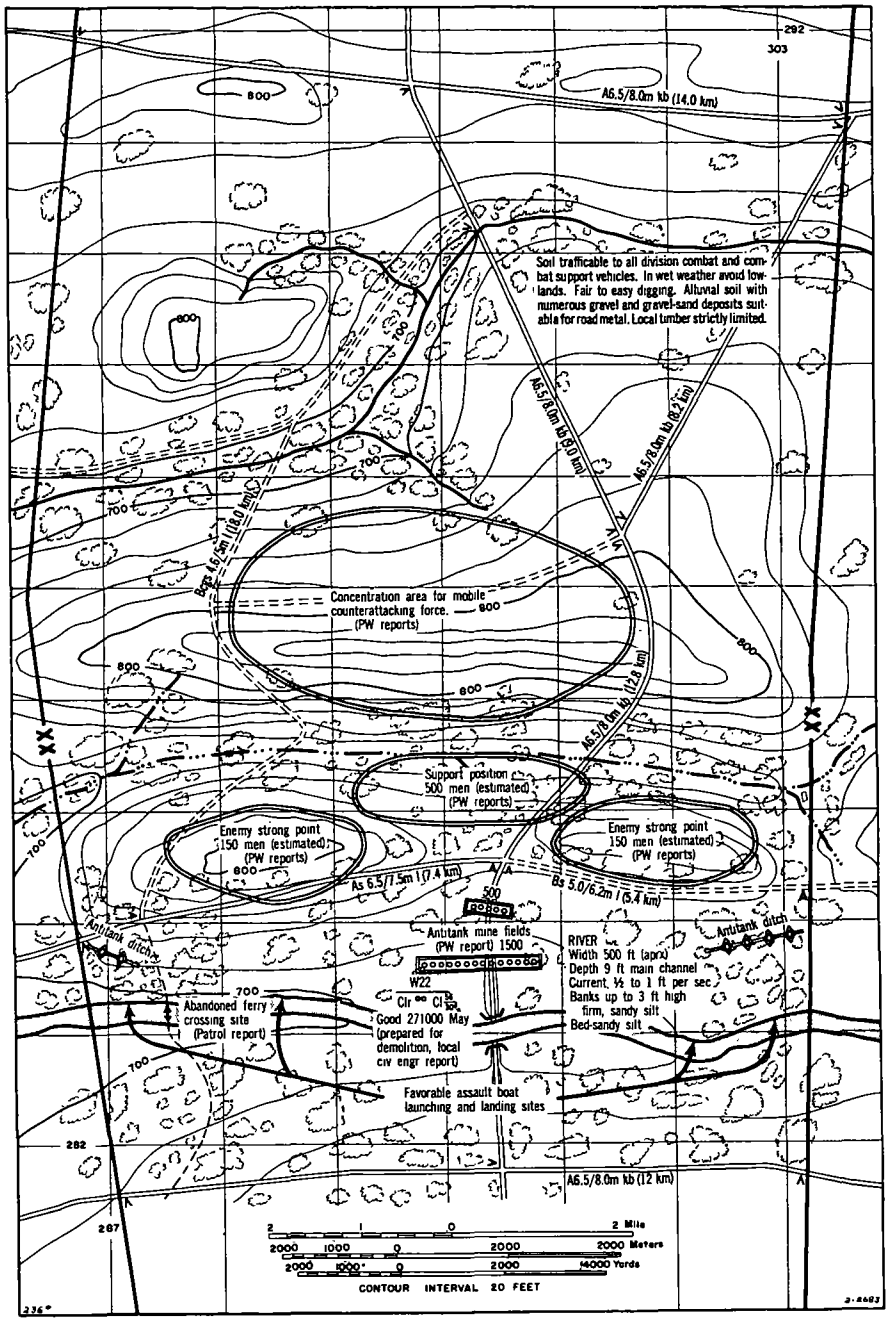
292
303
800
A6.5/8.0m kb (14.0 km)
Soil trafficable to all division combat and combat support vehicles. In wet weather avoid lowlands. Fair to easy digging. Alluvial soil with numerous gravel and gravel-sand deposits suitable for road metal. Local timber strictly limited.
A6.5/8.0m kb (8.0 km)
A6.5/8.0m kb (8.2 km)
700
Bs 4.5/7.5m (18.0 km)
Concentration area for mobile counterattacking force. (PW reports)
800
A6.5/8.0m kb (12.2 km)
Support position 500 men (estimated) (PW reports)
Enemy strong point 150 men (estimated) (PW reports)
As 6.5/7.5m (7.4 km)
Bs 5.0/6.2m (5.4 km)
Antitank ditch
Antitank mine fields (PW report) 1500
W22
Clr Clr
Good 271000 May (prepared for demolition, local civ engr report)
Abandoned ferry crossing site (Patrol report)
RIVER
Width 500 ft (apx)
Depth 9 ft main channel
Current, ½ to 1 ft per sec
Banks up to 3 ft high
firm, sandy silt
Bed-sandy silt
Favorable assault boat launching and landing sites
282
287
A6.5/8.0m kb (12 km)
2 1 0 2 Mile
2000 1000 0 2000 2000 Meters
2000 1000 0 2000 4000 Yards
CONTOUR INTERVAL 20 FEET

Figure 2. Example of a special map.

CHAPTER 3

OPERATIONAL PLANNING AND EXECUTION

Section I. OFFENSIVE CONSIDERATIONS

14. Sequence of Operations Planning

a. Preliminary planning begins with the higher field commander. Advance warning orders, necessary intelligence, and technical details are disseminated to subordinate echelons which will participate in the pending river-crossing operations. Logistical requirements are placed on higher headquarters and requirements for support of other services or special troop units are coordinated with appropriate headquarters.

b. Initial planning begins with the receipt of this information by the subordinate units. They alert their subordinate units and make tentative plans. It is desirable that all the units participating in the crossing complete these plans prior to the advance to the river line.

c. General planning is developed from the objective area toward the river line. The sequence is generally as follows:

(1) Select a desirable bridgehead.
(2) Estimate strength and type of troops necessary to hold the bridgehead.
(3) Determine time required for seizing the selected bridgehead.
(4) Consider seizure of any intermediate objectives.
(5) Estimate strength and allocation of assault troops.
(6) Estimate the quantity and type of fire support required.
(7) Determine most advantageous crossing means and areas.
(8) Determine amounts and types of crossing equipment and additional troops required, such as engineer and military police, and estimate times at which rafts and bridges should become usable.
(9) Determine the crossing sequence of units (crossing plan).
(10) Determine special training necessary.
(11) Determine combat service support requirements for each phase.
(12) Evaluate the command's vulnerability to enemy attack during various phases of the planned operation.
(13) Consider the development of deception means.
(14) Reevaluate overall requirements. Factors may appear in

the above sequence of planning which alter one item and thus require a reevaluation of other items.

15. Selection of Type Crossing To Be Conducted

a. The hasty crossing is preferred. The hasty crossing is feasible when the crossing areas are undefended or lightly held by the enemy or when friendly nuclear or CBR weapons are used to disrupt the enemy river line defenses, when forces are available to advance rapidly to the river. A hasty crossing is not predicated on the seizure of bridges intact.

b. The deliberate crossing is selected only—

(1) As a resumption of the offensive.

(2) When a hasty crossing is not feasible.

(3) As a result of an unsuccessful hasty crossing.

16. Planning Guidance

a. The headquarters having overall control of the operation, usually the corps, designates the bridgehead. Subordinate units may select objectives to be seized within the bridgehead.

b. Planning is accomplished to insure sufficient crossing means are available to the assault units for either a hasty or a deliberate crossing.

c. Overconcentration within the crossing area is avoided. See paragraphs 60 through 67.

d. Planning includes provision for air defense artillery and surface-to-air missile units to deny penetration of air space above the crossing sites by enemy aircraft and tactical missiles. If control of the air space above the crossing area cannot be assured for the crossing, consideration is given to night operations, extensive use of smoke, or timing the crossing to coincide with weather conditions which prohibit or reduce enemy air operations.

e. The fire support plan provides for the elimination of effective enemy fires on the crossing sites. Preplanned fires are included to seal off the bridgehead and retard movement of enemy reserves into the area.

f. The enemy can be expected to attack the bridgehead as early as possible, usually by armored attacks aimed at the crossing sites. To counter this threat, antitank weapons are carried with the advance elements of the assault, and air support is provided where possible.

17. Hasty Crossing

a. Planning. While the crossing is termed hasty, it is normally a result of detailed planning. The phasing discussed in paragraphs 18 and 19 is normally used. The planning for a hasty crossing

provides for rapid movement through the crossing area, rapid deployment on the far side, and early commitment of an exploiting force. Contingency plans are prepared to cover the effective use of bridges seized intact and to execute a deliberate crossing in case the hasty crossing fails. The use of special weapons may be planned to assist in the capture of a bridge intact. The hasty crossing emphasizes speed and aggressiveness and allows subordinate commanders sufficient freedom to exploit success. The necessary attachments and crossing means are provided. The line of departure may be a considerable distance from the river and plans should recognize that all assault forces will not reach the river simultaneously. Therefore, orders assign objectives but omit crossing times. The hasty crossing should result in the rapid seizure of sufficient area to insure that the crossing sites are relatively secure from enemy ground action.

b. Execution of a Hasty River Crossing. The approach to the river normally is made on a broad front after the rupture of the enemy's defenses on the near shore. The assault forces push forward rapidly to catch the enemy astride the river and to seize crossings at places where the opposition appears weakest. The advance elements of the assault units seize the crossing sites and advance to the far side to secure these sites. Captured bridges are checked for the presence of demolitions immediately after the crossing of the leading elements. A damaged bridge can often be made usable by installing prefabricated bridging. Upon securing the crossing sites, raft and bridge construction is begun without delay. See paragraph 24 for the considerations involved in raft and bridge construction. The bulk of the assault units passes immediately through the crossing area leaving minimum forces to secure the crossings. The security elements of the assault force defending the crossing area should be relieved early by successive elements.

18. Deliberate Crossing

A deliberate crossing is executed when a hasty crossing is impractical or has failed. The water's edge at the near bank normally is the line of departure. The bridgehead may be developed by the seizure of three objective areas. To protect the flanks, the traces of these objective areas are tied to the river line or with adjacent units at the boundaries. The following criteria are used in selecting the objective areas:

a. Objectives for first objective area should—

(1) Provide space to permit control of subordinate assault units to be regained by the commander of the force involved.

(2) Deny effective direct fire on the crossing sites.
(3) Eliminate resistance in the immediate area of the crossing sites.
(4) Be reasonably defensible.
(5) Permit construction of footbridges and rafts, if not already accomplished.

b. Objectives for second objective area should—
(1) Provide space to permit the assault force commander (normally the division commander) to reorganize his forces for continuing the attack.
(2) Remove enemy ground observation of the crossing sites.
(3) Provide a good defensive position.
(4) Enhance construction of bridges.

c. Final (bridgehead) objective area should—
(1) Provide space to accommodate the crossing force.
(2) Provide defensible terrain.
(3) When seized, complete the river crossing operation.
(4) Provide area for maneuver and terrain for the breakout from the bridgehead.

19. Phasing for a Deliberate Crossing

The phasing of a river-crossing operation is based on the distance of the bridgehead line from the river, the terrain in and around the bridgehead, the severity of the river obstacle, the capability of the assault forces, the fire support and logistical support available to the assault force, and the ability of the enemy force to interfere with the crossing and the advance on the far shore. The phasing of the logistical buildup should be carefully integrated with the tactical buildup.

a. One-Phase Crossing. Under extremely favorable circumstances it may be possible to cross a river and establish a bridgehead in a single sustained attack. This type crossing requires the attacker to have superior crossing means and an enemy capable of only limited counteraction prior to the seizure of the bridgehead.

b. Two-Phase Crossing.
(1) In a two-phase crossing the assault force crosses the river and proceeds directly to the objectives controlling the second objective area. Planned fires engage appropriate targets in the bridgehead area. If the situation permits the use of helicopters over enemy held areas, airmobile assaults may be conducted on the second phase objectives in conjunction with a ground assault.
(2) The second phase of the bridgehead operation is a coordinated attack to seize the final objectives and establish

control of the bridgehead. This completes the river crossing.

(3) Emphasis is placed on gaining sufficient advantage in the conduct of the operation to commit an exploiting force at the earliest possible time.

c. Three-Phase Crossing. The three-phase operation is the most deliberate type crossing. It consists of the following—

(1) The assault forces cross the river by all available means to secure the first objective area. Fire support is compatible with the degree of surprise attempted. Normally, the initial assault is accompanied by heavy fires prior to and during the crossing.

(2) The second and third phases include the tactical and logistical buildup and coordinated assault to secure the second objective area and bridgehead respectively. An exploitation force may then be committed.

20. Attack on a Broad or Narrow Front

Attack on a narrow front may be favored when access routes to the river are severely limited. Such a plan entails considerable risk. If the enemy correctly analyzes the attack, he can concentrate his forces and counteraction against critical crossing areas. An attack on a broad front disperses the enemy's defensive fires and delays the use of his reserves. By the use, or apparent use, of numerous crossing sites, enemy reaction may be delayed until the strength of the attacker in the bridgehead is sufficient to defeat enemy counteraction. Plans for a crossing always consider the attack on a broad front, while an attack on a narrow front is resorted to only when dictated by conditions of the terrain or a favorable enemy situation.

Section II. COMMAND AND CONTROL

21. General

The commander at each echelon determines whether to keep the means for crossing under his control or attach them to subordinate units. Normally, the division commander executing an assault crossing is provided control of all necessary crossing means to assure the success of his operation. Retention of control by corps is justified only when the road net, crossing means, or crossing areas are so limited that several major units require early use of the bridges and rafts in a division's zone. When control is initially by the assault divisions, provision is made for its passage to corps as soon as the assault division has the major portion of its units across the river.

22. Assignment of Engineer Troops and Equipment

a. The organic engineer battalion of a division is sufficient to support the river-crossing needs of the armored, infantry, or mechanized division only for small-scale operations.

b. Corps engineer units (including those made available to corps by army) are attached to or placed in support of divisions depending upon the control over the units required by the division commander and the amount and type of assistance required. These engineer units normally are under the control of the division engineer battalion commander.

c. The division engineers support the assault units on the far shore. Attached or supporting corps engineers usually are assigned the tasks of construction and operation of rafts and bridges. In an operation which requires considerable riverline engineer effort, the division engineers are given the riverline missions which would release them soonest to their normal far shore tasks.

23. Assignment of Military Police Troops

a. The organic military police company of a division normally is not sufficient to support the river-crossing needs of an assault division.

b. The corps attaches or places in support of the divisions additional military police units (including units made available by army) to support river-crossing operations as required.

c. The division military police support the assault units on the far shore by establishing traffic control posts, removing or diverting refugees, and relieving capturing-troops of prisoners of war. Attached military police usually are assigned traffic control tasks on both the near and the far shores in conjunction with division military police, maintain radio communications with them, and relieve them, in place, as they move forward. Attached military police revert to corps control upon completion of the assault phase.

24. Ordering Construction of Bridging

a. The construction of rafts and light bridges is initiated on order of the commander exercising assault control (normally the division commander in a deliberate crossing and a brigade commander in a hasty crossing).

(1) Normally, the assembly of rafts can be initiated earlier than bridges due to their lesser vulnerability to enemy fires.

(2) When confronted with a river 100 meters or more in width, the commander should order the installation of multiple raft sites. Assembly and operation of rafts

should begin as soon after H-hour as possible. Tanks and artillery pieces may thus be crossed prior to the time bridges can be placed in operation.

b. The construction of heavy floating vehicular bridges is initiated on order of the commander charged with the river crossing, normally the corps or division commander.

(1) When confronted with a river less than 100 meters in width, the initial advantage of speed in commencing operation of rafts may be more than offset by the greater efficiency of bridges which can be placed in operation in a short time.

(2) Construction of bridges should begin as early as possible. Planning for the crossing places great reliance on both bridges and rafts (par. 4, app. II). In a major river crossing it may be desirable to restrict the use of rafts to the crossing of tanks, heavier artillery, and other essential equipment during the early hours of the crossing. For this purpose, rafts can be used at separated raft sites to provide minimum vulnerability to nuclear attack.

c. The decision to order the initiation of bridge assembly is crucial and is based on an evaluation of the following:

(1) The mission.
(2) The combat and combat service support required by forces on the far side of the river.
(3) The amount of bridging available.
(4) The accuracy and intensity of enemy fires to include nuclear attacks on the crossing sites.
(5) The risk of possible loss of the bridgehead if sufficient tanks and other combat equipment cannot be crossed by rafting operations.
(6) The destruction of enemy fire delivery positions prior to and early in the crossing.
(7) Enemy observation and its attenuation by use of smoke and other means.

25. Time of Crossing

Whether a crossing is made in daylight or darkness depends on the need for concealment, state of training of troops, nature of the terrain, characteristics of the water obstacle, enemy disposition and capabilities (such as use of mine fields on far bank and ability to make air and tank attacks), and need for speed. Surprise is difficult to obtain in a daylight crossing, however smoke may be uesd to conceal the actual crossing and provide deception.

26. Buildup on Far Bank

a. The rate of buildup on the far bank must exceed the enemy's capacity for concentrating against the force. An enemy counterattack should be anticipated and the perimeter made secure before a hostile counterattack can be launched. It is essential that the attack keep moving. Reserve troops are employed to reinforce the assaulting troops to carry on the attack. Bridges, rafts, amphibious vehicles, and aircraft are used to place troops, equipment, and supplies on the far bank at the earliest opportunity. Supporting weapons are crossed promptly to increase the firepower in the bridgehead and to extend their range. The corps reserve crosses behind the reserve of assaulting divisions.

b. When the enemy has a nuclear capability, it usually is desirable to make subsequent crossings to the flanks of the initial crossing area in order to maintain adequate dispersion on the far side. When the initial assault crossings are reinforced by reserve units, dispersion may be maintained by expanding the bridgehead to the flanks.

27. Mopping Up

Mopping up on the far bank of the river is carried on concurrently with the advance inland. Since assault units must maintain the impetus of the attack, the task of mopping up is usually assigned to specific units of the reserve. If circumstances require elements of the assault echelon to mop up, provision is made for their relief as soon as possible. Mopping-up tasks may be assigned to organic or attached reconnaissance units. This responsibility must be specifically assigned in orders.

28. Functional Grouping

For *functional convenience and planning purposes only*, the river-crossing force may be divided into five basic echelons. These are the assault, fire support, engineer, followup, and rear echelons. *No command or operational control within echelons is implied nor is it intended to indicate a sequence of crossing.* The composition of these echelons varies with the tactical conditions encountered.

a. Assault Echelon. In addition to forces normal to offensive operations the assault echelon may be composed of amphibious vehicle units, engineer boat teams and guides, army aviation units, and smoke generator units.

b. Fire Support Echelon. Fire support is furnished by tactical air, naval gunfire, and the normal ground fire support means. Normally the fire support means of assault divisions are reinforced with corps and army field and air defense artillery units.

c. Engineer Echelon. The normal engineer support for a corps includes two or more engineer groups and additional attachments of engineer troops from army when required. The Engineer Amphibious Command (EAC) may be used to support river-crossing operations allowing the divisional engineers to continue uninterrupted close support to the assault units of the division.

d. Followup Echelon. The followup echelon consists of reserve combat units, far shore engineers, additional artillery, forward area weapons of air defense artillery, signal, military police, medical units, and other combat service support elements as required for immediate support of the assaulting units.

e. Rear Echelon. The rear echelon is composed of combat service support elements and others whose duties are not directly affected by the river-crossing operation.

Section III. SITE SELECTION

29. General

a. In the selection of crossing fronts, crossing areas, and crossing sites both the technical and tactical requirements are considered and evaluated. Terrain on the far shore in the vicinity of all crossing sites should enhance the local security of the site. Conflicts between tactical and technical requirements are normal. The commander weighs all the factors involved and arrives at the best over-all solution.

b. Technical considerations include the use of existing sites which are adaptable to construction or improvement of fords, including use of piling on which to construct "underwater bridges" or to reconstruct overwater bridges.

30. Assault Crossing Site

a. Each assault crossing site selected should accommodate a combat battalion, or a battalion or company task force. Desirable features include—

(1) A shoreline lightly held or undefended by the enemy.
(2) Ready access to a good avenue of approach to objectives on the far side.
(3) Dominating ground on near side for artillery observation and for support of the attack by direct fire.
(4) In nonnuclear war a salient in the riverline toward the attacker of such size and configuration that its use can be denied the enemy by fire. Use of such an area may facilitate crossing without being subjected to intense direct fires of the enemy.

(5) Covered approaches to the river.
(6) Existing routes leading to sites or easily constructed access routes from the existing road net to the site capable of handling vehicles.
(7) Moderate current.
(8) Unobstructed water area.
(9) Banks requiring minimum preparations for entrance and exit of amphibious vehicles.
(10) A channel without sharp bends or constrictions where current is accelerated.
(11) An area suitable for a raft site.

b. A crossing conducted when amphibious vehicles are not available requires two additional features.
(1) The availability of concealed assembly areas within a reasonable distance of the site.
(2) The availability of suitable attack positions adjacent to the site.

c. In nuclear warfare it is desirable to eliminate as many stopping points as possible. The necessity for occupying attack positions for any appreciable length of time is weighed against the enemy's target acquisition and delivery capabilities.

31. Raft and Amphibious Vehicle Crossing Sites

Desirable features for raft and amphibious vehicle crossing sites include—

a. Short, easily constructed access and egress roads between the existing road net and the site.

b. A gentle current near each bank at a straight reach of river.

c. Stream free from snags, rocks, shoals, islands, bars, and other obstructions which hinder crossings.

d. Cover and concealment on both shores for vehicles or personnel waiting to be loaded or unloaded.

e. Banks requiring minimum grading for approaches. At raft sites water close to the bank should be deep enough to float a loaded raft without grounding (par. 9*b*, app. II).

32. Floating Bridge Sites

Floating bridge sites should have—

a. Road nets on or near both shores.

b. Access roads requiring little preparation.

c. Banks firm enough to support the heaviest vehicles.

d. Stream current moderate and parallel to banks.

e. Stream free of snags, sand bars, islands, shoals, and large rocks that might hinder crossings.

f. Stream bottoms in which anchors hold but do not foul.

g. Existing or easily prepared equipment assembly sites on near bank.

h. Existing holdfasts capable of supporting anchor cables or guys. Existing bridge piers are useful for this purpose.

33. Number and Type Sites Required

a. The number and types of crossing sites required for an operation vary with the forces participating, the magnitude of the river obstacle, the speed desired, enemy dispositions and capabilities, the scheme of maneuver, and the crossing equipment available.

b. The following is an example and must not be used as a formula. Assume a corps crossing where the frontage is 50,000 meters, the river is 300 meters in width, the corps has 3,000 meters of bridging available, the opposing forces have a nuclear capability, and corps plans to attack with two mechanized divisions abreast. Assuming each division crosses with two brigades abreast with two assault battalions in each brigade, the following site selections might be made in each division crossing front.

(1) Four battalion assault crossing sites.
(2) Four heavy raft sites, with two or three rafts at each site.
(3) Two to four floating bridge sites well dispersed across the front.

Section IV. CROSSING MEANS

34. General

a. Plans include the use of special equipment as well as the use of any local means. Civilian boats, loading docks, and construction materials may facilitate the operation. See appendix II for additional information on crossing equipment.

b. See tables II, III, and IV for characteristics of and requirements for equipment.

35. Amphibious Vehicles

Armored carriers and tracked landing vehicles are preferred for transporting the assault waves. Unarmored amphibious vehicles are preferred for crossing supplies and equipment. For types and capabilities, see appendix II.

36. Aviation

Air Force and Army aircraft may be used to cross troops, artillery, equipment, and supplies by airlanding of air delivery. See Chapter V.

37. Assault Boats

When sufficient quantities of amphibious vehicles are not available, or when the nature of the water obstacle and its approaches and exits preclude their use, the commander may use assault boats. Such use reduces the speed of the crossing operation and increases the period of exposure to enemy counteraction. Assault boats may also be used for silent crossings, feints, and patrols.

38. Rafts

Rafts may be used to transport high-priority cargo across the river in the initial stage of the operation. Rafts provide a greater choice of crossing sites than bridges but may delay the building of bridges. On large unfordable rivers, rafts normally are the only initial means of crossing tanks and heavy vehicles. In later phases of the operation, rafts continue to cross returning vehicles and supplement the bridges. Raft sites are located downstream from bridges. Appendix II contains details on the transportation, construction, operation and capabilities of standard rafts.

39. Assault Bridges

a. Bridges are placed in operation as soon after H-hour as enemy observation and defensive fires are removed from the site. The assembly of bridging equipment and site preparation, to include construction of approaches, are important considerations in determining when a bridge can be placed in operation.

b. Consideration is given to using the approaches, abutments, piers, and anchorages of demolished bridges. However, such sites may be registered by hostile fires or their approaches mined or cratered; these deterrents considerably increase the time of bridge construction. Data on the transportation, construction, operation, capacities, and limitations of bridges are given in appendix II.

c. It is desirable that each assault division have in its crossing front a minimum of two floating bridges capable of carrying division loads. After the bridgehead has been established, additional heavy vehicular bridges, either floating or fixed, are erected as necessary (normally by army engineer units) and the mobile assault bridging is returned to the assault units.

d. Normal wear and tear and changes in water level necessitate constant maintenance of all bridges and their approaches. Local reserves of equipment and the necessary working parties are kept available. As it is often necessary to close bridges for temporary maintenance, the traffic plan allows for traffic diversions.

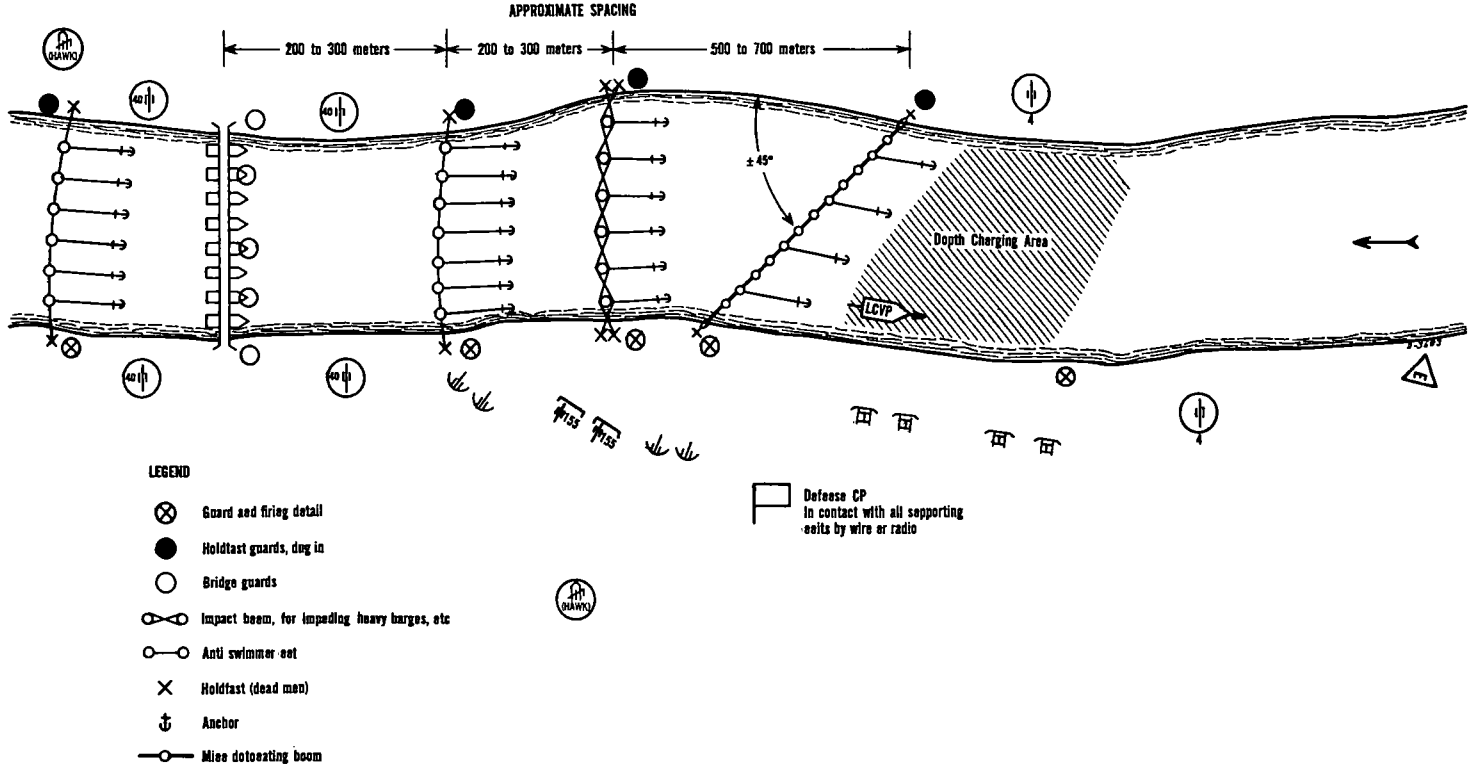

Figure 3. Bridge protective measures.

e. The engineers construct booms and nets upstream and downstream from the bridges for protection of the bridges. Protective devices are covered by fire and by all-weather surveillance. Figure 3 shows schematically some of the measures which can be taken to protect a bridge.

f. Ice has a disastrous effect on floating bridges unless the flow of ice under the bridge is carefully controlled. Blocks of ice may be passed under and between the float supports if the blocks are broken up into small chunks and pushed under the bridge. Ice jams are blown by explosives. Construction of floating bridges when ice is "running" on a river should be avoided. Floods and tides adversely affect the maintenance of floating bridges, particularly bridge approaches and abutments. Raft sites should be planned for use under such conditions.

Section V. SECURITY

40. Seizing and Holding the Near Bank

a. In a deliberate crossing the mission of seizing and holding the near bank normally is assigned to a unit not taking part in the assault. This unit clears the enemy from the near bank area during the advance to the river. Arrangements are made for the assaulting units to reconnoiter the river and prepare near bank installations. The near bank of the river and both flanks in the zone of action are secured against enemy observers and patrols.

b. In a hasty crossing, the force making the assault has the mission also of seizing crossing sites. Another unit following in support of the assault force is usually assigned the mission of holding and clearing the near bank.

41. Defense of Critical Areas

a. The local defense of all raft and bridge sites, concentration and assembly areas, supply points, and equipment dumps is coordinated.

(1) A single commander, the ground defense commander, is designated to command the crossing area defense in each crossing area. In emergencies, he may command all troops in the crossing area except those belonging to the assault units. Artillery is designated to support the defense of the crossing areas.

(2) An air defense commander is designated to control and coordinate air defense of the river along the crossing front.

(3) Means are provided for direct communications between

the commander of the crossing area defense and the corps artillery fire direction center, particularly after divisional artillery has crossed the river. Every means is employed to prevent the enemy from delivering accurate fire on the crossing sites.

b. Troops given the mission of ground defense of crossing sites remain in position until sufficient force has crossed into the bridgehead to secure the sites against counterattack.

(1) Ground defense includes the attack and neutralization of enemy stragglers, enemy patrols, guerrillas, and infiltrating forces, and protection against floating mines, river craft, and swimmer demolition parties.

(2) Antitank defense of the bridgehead is so important that, if possible, the first bridges to be built are sited with their far bank approaches located in areas which facilitate defense.

42. Defense Against Air Attack

a. All crossing areas are provided protection from air and missile attack. Bridge sites are particularly susceptible because of their static nature. Smoke may be used to provide concealment during assembly of equipment, erection, and after the bridge is placed in operation.

b. Air defense in support of a river crossing insures denial of the air space over all crossing areas. Alternate and dummy crossing sites selected to insure the success of the crossing plan are included in the air denial plan and defended against air attack. The senior air defense artillery commander is responsible for the detailed planning relative to air defense units and for the coordinated centralized control of the air space over and around crossing sites during the operation.

c. Air defense artillery units are deployed well forward, on the near side, at the earliest opportunity to provide depth of air coverage on the far side during the crossing and buildup of troops and vehicles. Particular attention is given to the low altitude attack, since a river is a likely avenue of approach for this form of attack. Again in the crossing plan, provisions are made for early crossing of appropriate air defense units to provide continuous air defense in support of the exploitation phase.

d. The use of area smoke screens is rarely compatible with close-in, direct antiaircraft fire, particularly that not controlled by radar.

e. Detailed discussion of air defense tactics is contained in FM 44–1.

43. Use of Smoke

The use of smoke to deny enemy air and ground visual observation of troop and equipment assembly areas, weapons positions, combat service support installations, crossing means, crossing sites, and objectives to be seized by the airmobile assault will aid in providing security for the crossing. In addition to the use of smoke to affect visibility attenuation, its use attenuates the thermal effect of nuclear bursts which may serve to increase the use of smoke. Details of smoke usage are covered in paragraph 50.

Section VI. FIRE SUPPORT

44. Fire Support Plan

a. When the initial assault is to be conducted at night, a silent crossing may achieve surprise. However, a fire support plan is prepared and coordinated so that fires can be delivered on-call.

b. For a daylight assault, the maximum fire support is planned for each phase of the operation. The area involved should be isolated by fires. Where the width of the crossing front precludes retaining all of the artillery under centralized control, at least a portion of the artillery is retained in general support of the force. These general support fires are then shifted as required by the changing situation. See FM 6–20–1, FM 6–20–2, and appendix IV.

45. Coordination With Air Force and Navy

When a river crossing requires close air support, consideration is given throughout all phases of planning to the information and planning requirements of the Air Force. If the crossing operation is likely to involve the use of naval personnel, similar attention is given to the Navy's requirements. Army, Navy, and Air Force commanders and staffs exchange information, coordinate plans, and maintain close liaison.

Section VII. COMMUNICATIONS

46. Means

All available means of signal communications should be employed during a river crossing operation. Prior to a deliberate crossing, the use of radio may be restricted to assist in obtaining surprise as to the time or place of crossing. Maximum reliance is placed on wire communications, supplemented by messenger visual, and sound signals. After the assault begins, or during a hasty crossing, greater reliance must be placed on radio communications.

Almost complete reliance must be placed on radio communications within the bridgehead area during the assault. This increased reliance on radio communications requires emphasis on approved communications procedures and discipline.

47. Communication Plan

The communication plan for any particular crossing operation provides for multiple means to be established early so commanders on the near shore can keep informed of the progress on the far side of the river. The communications plan is in the signal annex to the operation order. See appendix IV. Units having heavy communication traffic in a river crossing, for example engineer and military police units, require their own radio and wire nets. Communications are established and maintained between the crossing area commander and the engineer and security units at the crossing sites, as well as the traffic control posts, holding areas, and the TOC. A detailed discussion of communications is contained in the pertinent 11-, 24-, and 61-series field manuals.

Section VIII. COMBAT COVER AND DECEPTION

48. General

Employment of all types of combat deception measures in river crossing operations is emphasized. Judicious use of deceptive measures achieves maximum surprise, causes the enemy to redispose his forces in a manner which favors the crossing operations, and protects friendly forces and river crossing equipment. See FM 31–40.

49. Demonstrations and Feints

a. Demonstrations at selected points along the crossing front assist in deceiving the enemy as to the exact location of the actual crossing.

b. Feints to force the enemy to disclose his dispositions and commit his reserve are designed to gain time during the critical period of reorganization on the far bank. Feints are so planned, timed, and executed that if the feinting troops gain a decided advantage, immediate steps may be taken to exploit their success.

c. Both demonstrations and feints are conducted only on the authority of the crossing force commander.

50. Smoke

a. Smoke may be used in conjunction with feints and demonstrations either to conceal the forces involved or to present an

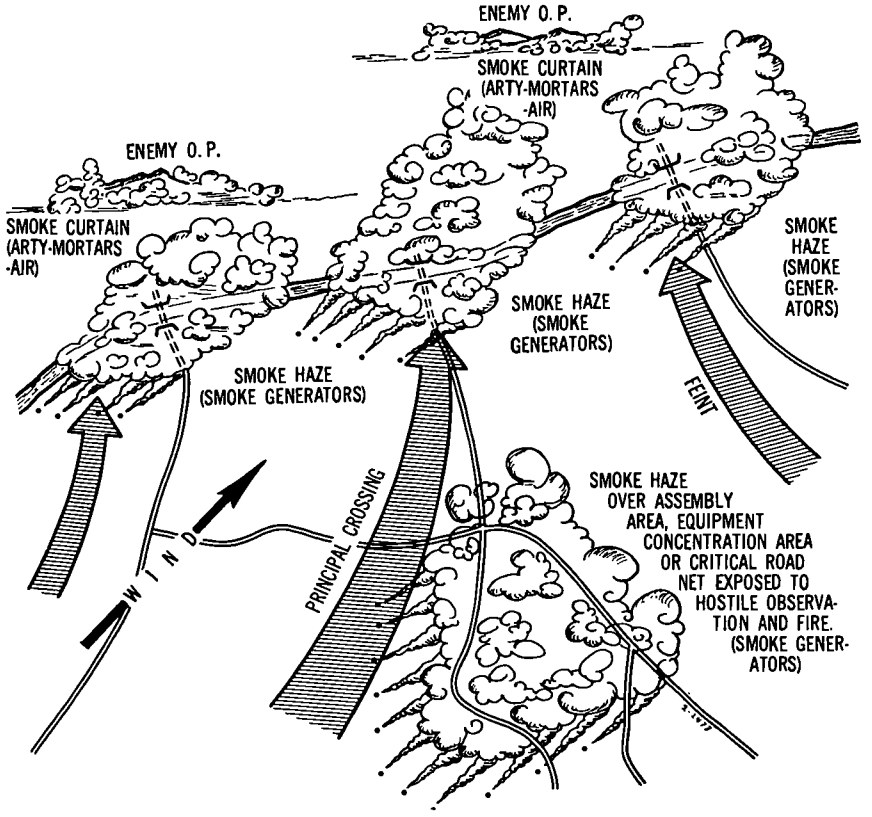
ENEMY O. P.
SMOKE CURTAIN (ARTY-MORTARS -AIR)
ENEMY O. P.
SMOKE CURTAIN (ARTY-MORTARS -AIR)
SMOKE HAZE (SMOKE GENERATORS)
SMOKE HAZE (SMOKE GENERATORS)
SMOKE HAZE (SMOKE GENER-ATORS)
FEINT
SMOKE HAZE OVER ASSEMBLY AREA, EQUIPMENT CONCENTRATION AREA OR CRITICAL ROAD NET EXPOSED TO HOSTILE OBSERVA-TION AND FIRE. (SMOKE GENER-ATORS)
PRINCIPAL CROSSING
WIND

Figure 4. Smoke screens used for concealment and to deceive the enemy as to the exact location of the crossing.

appearance of an activity which does not actually exist. When deception is desired, smoke is maintained in extent and density comparable with that employed in the actual area of operations (fig. 4).

b. Whenever emplaced smoke is used, it is necessary to have 360° coverage of the area to be screened. To accomplish this in a river crossing operation, smoke units must be included as part of the assault team in order to get supplies and equipment to the far shore as soon as possible.

c. Due to the limit smoke places on visibility, assault units which are to move through a smoke screen must determine azimuths over which they are to proceed and the artillery must fire registration and preplan fires before smoke is made.

d. The use of smoke is coordinated and controlled by the commander charged with the river crossing operations.

Section IX. SPECIAL CONSIDERATIONS

51. Chemical Agents

River crossing operations provide opportunities for the effective employment of chemical agents by both the attacker and defender. See FM 3–5 for detail.

52. Artificial Illumination

For a night crossing artificial illumination can be used to disclose enemy positions on the far side of the river and to provide light for reorganization. Construction of crossing means during hours of darkness can be hastened through the use of artificial illumination. In a silent crossing under cover of darkness where an effort is being made to achieve total surprise, artificial illumination adds speed after the initial assault is launched and surprise is lost.

53. Electronic and Communications Deception

Prior to a crossing, electronic, wire communications and communications deception may be used to assist in obtaining surprise as to the time or place of crossing. See FM 24–150 and FM 32–10.

Section X. TRAINING AND REHEARSAL

54. Training

Combined training of the various units participating in the initial assault is desirable. During this training period units should bring their equipment to a high state of repair, complete their basic load, and prescribed loads of supplies. An example of a typical infantry division training program for a river crossing is contained in appendix III.

55. Rehearsals

A rehearsal, based on the actual operation and logistical plan, improves coordination between the troops making the crossing and all supporting troops. Where possible units draw special equipment required to conduct the crossing and train in the use of this special equipment.

CHAPTER 4

COMBAT SERVICE SUPPORT PLANNING AND EXECUTION

Section I. BASIC CONSIDERATIONS AND SUPPLY PLANNING

56. Basic Considerations

a. Combat service support planning for a river-crossing operation is generally the same as for other types of operations. Emphasis is placed on insuring continued support during the period that assault forces are separated from their support installations by the river and minimizing congestion in the crossing area.

b. See FM 54–2, FM 101–5, and FM 100–10 for details of combat service support procedures and responsibilities. See also appendix IV.

c. River crossing operations require special considerations for supply, medical evacuation, and control and use of transportation.

d. Where a passage of lines takes place, maximum use of the combat service support facilities of the unit being passed through is made by the unit executing the river crossing.

57. Supply Planning

a. As soon as the situation permits, supplies required by the assault troops are delivered to the far side of the stream. The initial supplies, unit prescribed loads, are transported across by boats, rafts, amphibious vehicles, or aircraft. Continued supply support is provided by preloaded vehicles and aircraft that either cross on-call or as soon as practicable after the initial assault.

b. Plans provide for—

(1) Increased quantities of class V for preparatory fires and the assault.

(2) Early establishment of supply storage areas or distributing points and means for their control on the far side.

(3) Minimum stock levels of critical supplies adequate to insure continued operation in case of interruption of traffic crossing the river.

(4) The buildup and control of stock levels to support further offensive operations.

(5) Prompt alleviations of critical supply situations which may occur. Since stock control may be lost in the distributing points in the bridgehead, alternate procedures such as resupply from rear facilities may be more rapid.

Section II. MEDICAL SUPPORT

58. General Considerations

Company aidmen, litter bearers, and aid station personnel cross with their supported units. Battalion aid stations are established in the bridgehead as early as possible. Individuals requiring medical attention are collected at aid stations, treated, and held until they can be evacuated to the near shore. Division ambulances accompany medical platoons of the assault battalions whenever feasible to expedite evacuation. Designated boats, rafts, amphibious vehicles, and aircraft are used to evacuate patients from the far shore early in the operation. Detailed medical considerations are in FM 8–15.

59. Clearing Stations

Division clearing stations and hospitals are echeloned to cross the river as early as practicable. The nature of a river crossing dictates decentralization of control of medical source. The clearing stations prepare to care for an overload of patients pending the resumption of normal evacuation to supporting medical installations.

Section III. TRAFFIC REGULATION AND CONTROL

60. Terms

a. A traffic regulating line is selected for each phase of the river-crossing operation and indicates the forward limit of responsibility for traffic regulation and control as exercised by the commander having overall control of the operation (fig. 5). This normally would be located immediately in rear of assault battalions to relieve the assault commanders of responsibility for traffic in their rear. Other traffic regulating lines may be established to facilitate the control of vehicular density throughout the division and to indicate the forward edge of corps area of responsibility.

b. Staging areas are waiting spaces located far enough from the river to allow the maximum use of alternate routes to crossing sites (fig. 5). Staging areas are located and employed to handle traffic entering the assault unit's area, for example, corps and army support units and supply convoys. Combat and combat support units participating in the assault and division reserve and support units move directly from their near shore positions via the designated crossing means to the far shore without passing through a staging area.

c. Holding areas are waiting spaces located on the near and far side of the river just outside of the crossing area (fig. 5). The holding areas are located off the road and assist in the continued flow of traffic by preventing undue congestion of vehicles in the crossing area.

d. Dispersal areas are defined zones within the crossing area in proximity to the crossing means where vehicles can be halted and dispersed. The dispersal area avoids congestion on the crossing access road by allowing for temporary storage of the crossing traffic when the traffic has been disrupted or there is a reduction in the crossing means. Vehicles are dispatched from the dispersal area to the stream in accordance with the capability of the reduced crossing means. The dispersal area detail operates under and is in constant communication with the crossing area commander (fig. 5).

e. An *engineer regulating point* is a location where engineer personnel supervise traffic prepared to cross to insure compliance with the technical requirements of the available crossing means (fig. 5). This supervision includes—

(1) Determining the classification for each available crossing means as to load limitations; disseminating such information to traffic headquarters and to units.
(2) Inspecting vehicles to insure proper classification.
(3) Halting and recommending the rerouting of certain traffic when technical difficulties make one or more of the crossing means inoperable or reduce its capacity.
(4) Assisting the traffic headquarters in maintaining maximum traffic flow consistent with the means available.

f. The crossing area commander is an individual specifically designated by the division commander for each crossing area and vested with authority to exercise absolute control of the crossing means over the river and the traffic entering and within a specific crossing area (fig. 5). He insures that the crossing plan is properly executed. He insures that his crossing area is devoid of all except essential personnel and equipment and that there is no undue concentration within his crossing area. The crossing area commander may be an assistant division commander in a critical crossing area or a brigade executive officer or battalion commander in a less important crossing area.

61. Movement Plans

The orderly continuous movement of the force across the water barrier to meet the needs of troops on the far side requires detailed and responsive plans for both surface and air movements. Movement planning for a river crossing is complicated by the lack

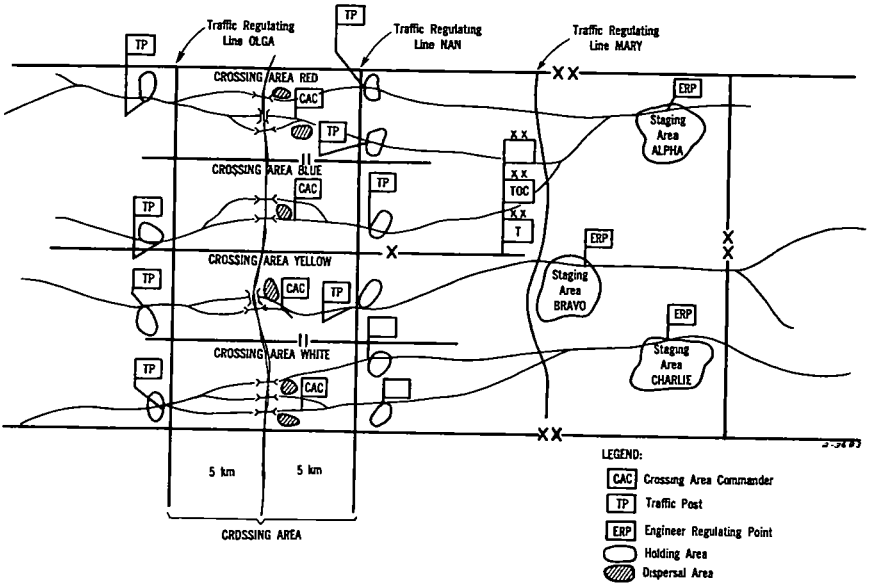

Figure 5. Traffic facilities for a river crossing.

of crossing means early in the operation and the fact that the assault bridging is one way and constitutes a defile (app. IV). In addition to normal information the surface movement plan should make provision for—

(1) Location of assault crossing sites and allocation to various tactical units.

(2) Location of raft sites, capacities, time of opening, and vehicles and units to cross in priorities.

(3) Location of amphibious vehicle crossing sites and prescribed times of allocation to various units.

(4) Location of bridges showing capacities, time of opening, and vehicles to cross in priorities.

(5) Control measures to include time control passes to next higher headquarters and traffic circulation plan.

62. Traffic Regulation and Control Plans

a. Traffic regulation and control plans govern the movement by ground and water means of troops, equipment, and supplies throughout the river crossing operation. The purpose of these plans is to expedite the crossing of vehicles and minimize congestion to reduce the vulnerabality to enemy fires. The basis of these plans is the crossing plan. Unforeseen problems are inherent in river crossing, and the crossing plan may require rapid modification. Changes to the crossing plan are coordinated in the tactical

operations center (TOC) and instructions are given to the traffic headquarters where the technical details are resolved. The traffic headquarters prepares the required changes to the road movement plan and the traffic regulation and control plans. Once the changes are approved, the TOC issues appropriate instructions to the crossing units and crossing area commanders. The traffic headquarters modifies the traffic regulation and control plans to conform to the revised road movement and crossing plans. All movement to and beyond the crossing area, but not within the crossing area, is directed from the TOC through the traffic headquarters, which provides efficient highway regulation and control by coordinating and regulating the movement of surface traffic. The traffic headquarters operates within or adjacent to the TOC during river crossings. FM 55–31 and FM 100–10 cover details of the operation of the traffic headquarters.

b. Within a crossing area the regulation and control of traffic between the holding areas on the near and far shore is the responsibility of the crossing area commander. This is done in accord with the priorities in the current crossing plan. Military police under his control expedite the crossing, prevent congestion, and clear the crossing area of nonessential personnel and equipment. The crossing area commander acts in close coordination with TOC, the senior engineer in his crossing area, and commanders of elements designated to cross within his crossing area.

c. Division and corps traffic regulation and control plans provide for—

(1). Control of movement.
(2) Staging and holding areas.
(3) A communication system connecting TOC, crossing area commanders, traffic headquarters, staging areas, holding areas, traffic control posts, both ends of the bridges, and other points of concern to the commander.
(4) Traffic control posts on both near and far shores.
(5) Engineer regulating points.
(6) Contingencies to permit directing of traffic to various crossing sites.
(7) A traffic-circulation map.
(8) Traffic regulating lines.
(9) The transfer of traffic regulation and control responsibility from division to corps.
(10) A priority list showing the order of crossing of units or elements, giving primary consideration to the combat needs of the assault divisions.

63. Priority Convoys and Essential Vehicles

a. Convoys are scheduled in the crossing plan according to their priority for crossing. Convoys are plainly marked with their priority and serial number to expedite arrangement of convoys.

b. The division commander designates the number and types of essential vehicles to cross the stream. These vehicles are marked with a special sign and receive high priority for crossing means. Command, communications, and ambulance vehicles normally are designated essential vehicles and receive priority over convoys.

64. Traffic Emergencies

Exceptionally strong or weak enemy resistance may require changes in priorities of combat or combat support units and class III and V supply vehicles, and may otherwise affect the type of traffic crossing rafts and bridges. If bridges are damaged or destroyed, vehicles are routed into holding and dispersal areas by the effected crossing area commanders until bridge traffic can be restored or the vehicles rerouted.

65. Communications for Traffic Control

Initially, traffic control posts are wired in to existing facilities to provide communications from these posts to traffic headquarters and to crossing area commanders. As the crossing commences, and restrictions on radio are lifted, communications between the crossing area commanders and traffic control posts is by radio, supplemented by messengers and wire. As the far bank of the river is consolidated, every effort should be made by all units to extend existing wire circuit across the river. Radio relay systems should be installed across the river as soon as the tactical situation permits.

66. Method of Identifying Vehicle Cargoes

Emergency situations require the change in priority of certain vehicles loaded with particular equipment and supplies, such as river crossing equipment or supplies needed on the far shore. The location of these vehicles is facilitated if a list of the contents is chalked on the sides of each vehicle carrying such equipment.

67. Unit Serials

a. Vehicles and troops that are to cross the bridges or are to be transported by air are grouped into unit serials in the order in which they are required on the far side of the river and into columns or loads based on the carrying capacity of crossing means to be employed. Tactical unity is maintained as far as practicable. A provisional allotment of serials with their times of crossing

are made for each crossing means used. Regardless of scheduling, vehicles, serials, and convoys move from the staging or holding area to the crossing means only on call of the crossing area commander.

b. When the crossing plan for the surface element provides for two or more bridges per crossing division, the allocation of a combined priority for all serials capable of crossing these bridges insures the overall order of movement, across the remaining bridge or bridges is clear, if one of the bridges is damaged or destroyed.

Section IV. PRISONERS OF WAR AND CIVIL AFFAIRS

68. Prisoner of War Control

Prisoners of war are expeditiously evacuated from the bridgehead area using any available secondary crossing means. A division prisoner of war collecting point normally is established on the near side of the river sufficiently far to the rear to prevent intereference with tactical operations and river line activities. Normal prisoner evacuation and interrogation procedure is established when the division prisoner of war collecting point moves to the far side of the river. Maximum use is made of returning transportation.

69. Civilians and Displaced Personnel Control

Rigid control of the movement of civilians is necessary. Civilians living in the near-bank area and those living in the bridgehead area are kept in place unless particular requirements of the situation necessitate evacuation of limited areas. Refugees and local civilians, if necessary, are quickly moved away from the river to designated areas in rear of the staging areas. Refugees are not allowed to assemble along the far bank of the river during movement from the fighting zone to the rear. They are crossed promptly on secondary means. It may be necessary to establish foot bridges or light rafts to insure their rapid passage to the rear. Separate routes are established and controlled to avoid congestion of main troop and vehicular routes. Civilians are not allowed to cross the river from the near bank to the far bank or to move along the river line.

CHAPTER 5

AIRBORNE FORCES, AIRMOBILE FORCES, AND SPECIAL CONDITIONS

Section I. AIRBORNE FORCES AND AIRMOBILE FORCES

70. Employment of Airborne Forces

Airborne forces may be employed in joint airborne operations in conjunction with river-crossing operations. Details concerning airborne operations are covered in FM 57–10 and FM 61–100.

71. Tactical Missions

a. When an airborne force is employed in a river-crossing operation, the following are appropriate missions for such a force:

(1) Seize a bridge or bridges intact ahead of advancing ground units.
(2) Establish a bridgehead.
(3) Seize key terrain in the vicinity of or within the planned bridgehead to—
  (*a*) Prevent the movement of enemy reserves.
  (*b*) Facilitate the crossing and the exploitation of the bridgehead by ground troops.
(4) Attack defended areas in the enemy's river line defenses.
(5) Reinforce troops within the bridgehead.

b. In river-crossing operations troop carrier aircraft may deliver supporting weapons to include light and medium artillery into the bridgehead by heavy drop or by airlanding.

72. Air Movement of Airmobile Forces

a. Army aircraft provide the commander with a means of airlifting tactical elements of his command to increase the rate of troop buildup in the bridgehead, to expedite supply or evacuation and to extend combat and administrative support dispersion.

b. Appropriate tactical missions for airmobile forces include early reconnaissance of the river line and the objective area, seizure of the far shore objectives and points which dominate proposed crossing sites, denial of selected routes in the vicinity, and feints and demonstrations.

c. Details of airmobile operations are in FM 57–35.

Section II. SPECIAL CONDITIONS

73. Cold Weather Conditions

a. Ice often complicates stream crossings. Assault boats are

vulnerable to floating ice and may be damaged if forced through ice layers. Normal floating bridges require protective measures to prevent damage to their floats.

b. Ice bridges can be used under certain conditions such as crossing open channels having a slow-moving current if the ice is thick enough or can be strengthened to support the desired load. If the ice is weak or there is open water, standard floating bridges are used. Special precautions are necessary near the edge of ice and open water. Floating bridges should be removed before the spring breakup.

c. Thick ice may be crossed with little difficulty. The ice layer may be reinforced by adding timber treads or other load distributing devices. See FM 31–71 and FM 31–72.

d. Table I is a guide to determine the minimum thickness of clear ice (supported by water) required to support certain loads and spacing required between the loads.

Table I. Carrying Capacity of Ice

Loads	Minimum thickness of ice (in.)	Minimum interval between tracks or distance between elements (ft)
Single rifleman on skis or snowshoes	1½	16
Infantry columns, motorcycle, unloaded sleds	4	33
Single light artillery piece; ¼-ton truck, 4 x 4	6	49
Light artillery, passenger cars, medium 1½-ton trucks, light total load of 3½-tons.	8	65
2½-ton trucks, light loads	10	82
Closed columns of all arms except armor elements and heavy artillery.	12	98
20-ton vehicles	16	131
45-ton vehicles	24	164

74. Swamp Areas

Swamps present particular problems to an attacking force. Most vehicles and heavy equipment are limited to the main routes of communication. Standard bridges are used to close gaps in the main lines of communication. As in the case of defiles, the speed of the advance over the restricted number of routes through the swamp is increased if possible.

75. Causeways

Causeways leading in the direction of advance constitute defiles. Causeways are ordinarily encountered either across swampy areas or in shallow flooded areas. The enemy may destroy the

causeway forcing the attacking troops to assault the far side of the breach. Capture of the causeway may be accomplished by the rapid advance of forward units. Airborne or airmobile units may be dropped on the far side to prevent destruction of the causeway. Forcing a crossing through the swamps or flooded areas surrounding the causeway may require special equipment such as shallow draft boats. An operation of this type is similar in many respects to the crossing of a wide river.

76. Very Wide Rivers

Very wide rivers (over 300 meters in width) present specialized crossing problems that ordinarily require assistance from army or higher headquarters. Such crossing operations may have a pattern similar to shore-to-shore movements and differ from ordinary crossings in that greater emphasis is given to special equipment, training, and large-scale rehearsals. See FM 31–12.

a. Use of Barges. In addition to normal crossing means, barges and other river craft are usable in crossing very wide rivers. They should be located and moved to the bridge and raft sites. Barges may be weighted, sunk, and used as piers for either floating or fixed bridges. They may be kept floating, securely anchored, and used as pontons for expedient floating bridges in place of, or in addition to, standard bridges. Barges and other craft are used to ferry supplies, equipment, troops, and vehicles across the river.

b. Use of Navigation Equipment. When very wide rivers are crossed under cover of darkness, pathfinders may be sent across the river just before the assault crossing to guide the assault troops to their intended landing areas by means of infrared beams or other means.

APPENDIX I

REFERENCES

DA Pam 108–1	Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings.
DA Pam 310–1	Index of Administrative Publications.
DA Pam 310–2	Index of Blank Forms.
DA Pam 310–3	Index of Training Publications.
DA Pam 310–4	Index of Technical Manuals, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.
DA Pam 310–5	Index of Graphic Training Aids and Devices.
JCS Pub 1	Dictionary of United States Military Terms for Joint Usage.
AR 320–5	Dictionary of United States Army Terms.
AR 320–50	Authorized Abbreviations and Brevity Codes.
FM 1–5	Army Aviation; Organizations and Employment.
FM 1–15	Aviation Battalion, Infantry, Airborne, Mechanized, and Armored Divisions.
FM 1–60	Army Aviation Air Traffic Operations—Tactical.
FM 1–100	Army Aviation.
FM 3–5	Chemical, Biological, and Radiological (CBR) Operations.
FM 3–50	Chemical Smoke Generator Battalion and Chemical Smoke Generator Company
FM 5–1	Engineer Troop Organizations and Operations.
FM 5–34	Engineer Field Data.
FM 5–36	Route Reconnaissance and Classification.
FM 5–135	Engineer Battalion, Armored, Mechanized, and Infantry Divisions.
FM 5–136	Engineer Battalion, Airborne Division.
FM 6–20–1	Field Artillery Tactics.
FM 6–20–2	Field Artillery Techniques.
FM 7–11	Rifle Company, Infantry, Airborne Infantry, and Mechanized Infantry.
FM 7–15	Infantry, Airborne Infantry, and Mechanized Infantry Rifle Platoons and Squads.
FM 7–20	Infantry, Airborne Infantry, and Mechanized Infantry Battalions.
FM 7–30	Infantry, Airborne, and Mechanized Division Brigades.
FM 8–10	Medical Service, Theater of Operations.
FM 8–15	Division Medical Service, Infantry, Airborne, Mechanized, and Armored Divisions.

FM 8–35	Transportation of Sick and Wounded.
FM 9–30	Maintenance Battalion; Division Support Command.
FM 10–33	Airborne Division Quartermaster Air Equipment Support Company.
FM 10–50	Supply and Transport Battalion, Division Support Command.
FM 11–50	Signal Battalion, Armored, Mechanized, and Infantry Divisions.
FM 11–57	Airborne Division, Signal Battalion.
FM 17–1	Armor Operations; Small Units.
FM 17–15	Tank Units; Platoon, Company, and Battalion.
FM 17–30	The Armored Division Brigade.
FM 17–34	Amphibious Tank and Tractor Battalions.
FM 17–36	Armored Cavalry Platoon and Troop, Air Cavalry Troop, and Divisional Armored Cavalry Squadron.
FM 19–5	The Military Policeman.
FM 19–10	Military Police Operations.
FM 19–25	Military Police Traffic Control.
FM 19–40	Handling Prisoners of War.
FM 19–90	The Provost Marshal.
FM 21–5	Military Training.
FM 21–26	Map Reading.
FM 21–30	Military Symbols.
FM 21–60	Visual Signals.
FM 24–150	Electronic Warfare (U).
FM 25–10	Motor Transportation, Operations.
FM 27–10	The Law of Land Warfare.
FM 30–5	Combat Intelligence.
FM 30–10	Terrain Intelligence.
FM 31–10	Barriers and Denial Operations.
FM 31–12	Army Forces in Amphibious Operations (The Army Landing Force).
FM 31–21	Guerrilla Warfare and Special Forces Operations.
FM 31–40	Tactical Cover and Deception.
FM 31–70	Basic Cold Weather Manual.
FM 31–71	Northern Operations.
FM 31–72	Mountain Operations.
FM 32–5	Communications Security (U).
FM 32–10	United States Army Security Agency in Support of a Field Army (U).
FM 33–5	Psychological Operations.
FM 41–10	Civil Affairs Operations.
FM 44–1 & 44–1A	Air Defense Artillery Employment (U).

FM 44–2	Light Antiaircraft Artillery (Automatic Weapons).
FM 44–4	Medium and Heavy Antiaircraft Artillery.
FM 54–2	Division Logistics and the Support Command.
FM 55–6	Transportation Services in Theaters of Operation.
FM 55–31	Motor Transport Service in Theaters of Operation.
FM 57–10	Army Forces in Joint Airborne Operations.
FM 57–35	Airmobile Operations.
FM 57–38	Pathfinder Guidance for Army Aircraft.
FM 61–100	The Division.
FM 100–5	Field Service Regulations—Operations.
FM 100–10	Field Service Regulations, Administration.
FM 100–15	Field Service Regulations, Larger Units.
FM 101–5	Staff Officers Field Manual, Staff Organization and Procedures.
FM 101–10	Staff Officers Field Manual, Organization. Technical, and Logistical Data.
FM 101–31	Staff Officers' Field Manual, Nuclear Weapons Employment (U).
TM 5–210	Military Floating Bridge Equipment.
TM 9–238	Deep Water Fording of Ordnance Material.
TM 55–505	Amphibious Truck Drivers' Handbook.
ACP 105 A	Title classified.
ACP 151 A	Title classified.
ACP 165	Operational and Brevity Codes.

APPENDIX II
CROSSING EQUIPMENT

1. General

Crossing equipment employed in river-crossing operations includes assault boats, footbridges, light raft sets, floating vehicular bridges, heavy rafts, and fixed bridges assembled from components of floating vehicular bridge sets, prefabricated fixed bridges, armored carriers, amphibious vehicles, army aircraft, and special craft. The use of the above equipment depends on its availability, characteristics of the river, availability of operating personnel, and security provisions. Portable and nonportable fixed bridges may be used to meet special requirements but generally are not used extensively in the early phases of an operation.

2. Assault Boats

a. Reconnaissance Boat (fig. 6). The three-man reconnaissance boat weighs 24 pounds, 33 pounds in pack with paddles and pump. This boat can be inflated in 5 minutes.

b. Plastic Assault Boat (fig. 7). The assault boat M3 is 4.9 meters in length, weighs 300 pounds and transports 12 passengers with packs in addition to a crew of 3. A stack of 10 inverted boats can be carried on a 2½ ton utility pole-type trailer or on a 2½

Figure 6. Three man reconnaissance boat.

Figure 7. Plastic assault boat.

Figure 8. 15 man pneumatic assault boat.

ton 6 x 6 cargo truck. It may be used as a storm boat, and in this role a 25 HP outboard motor is attached. This assembly, carrying one operator and five infantrymen, can exceed 20 mph and will withstand beaching at full speed.

c. Pneumatic Assault Boat (fig. 8). The pneumatic assault boat is 5.2 meters in length, weighs 260 pounds and transports 12 passengers with equipment in addition to a crew of 3. It may be propelled by paddle or by outboard motor. The stern of the boat is equipped for mounting a standard 25 HP outboard motor. Caution must be exercised when operating the boat with an outboard motor for a sudden surge of power may damage the boat.

d. For use of assault boats to evacuate patients, see FM 8–35.

Table II. Assault Boats

1	2	3	4	5		
River crossing means	Crew (Engrs)	Maximum loads	Max stream velocity	Time in min for round trip across stream w/width of—		
				90m	150m	300m
1. Plastic Assault Boat:						
a. Paddle propelled	3 men	12 riflemen with individual equipment (in addition to crew).	1.5m/sec	4	6	10
b. Employed as storm boat.	1 man	5 riflemen (in addition to crew).	3.3m/sec	-----	3	4
c. Outboard motor propelled.	2 men	10 riflemen (in addition to crew).	2.4m/sec	-----	4	5
2. Pneumatic assault boat:						
a. Paddle propelled	2 men	12 riflemen with individual equipment (in addition to crew).	2.4m/sec	4	6	10
b. Outboard motor propelled.	1 man	14 riflemen (in addition to crew).	3.3m/sec	-----	4	5

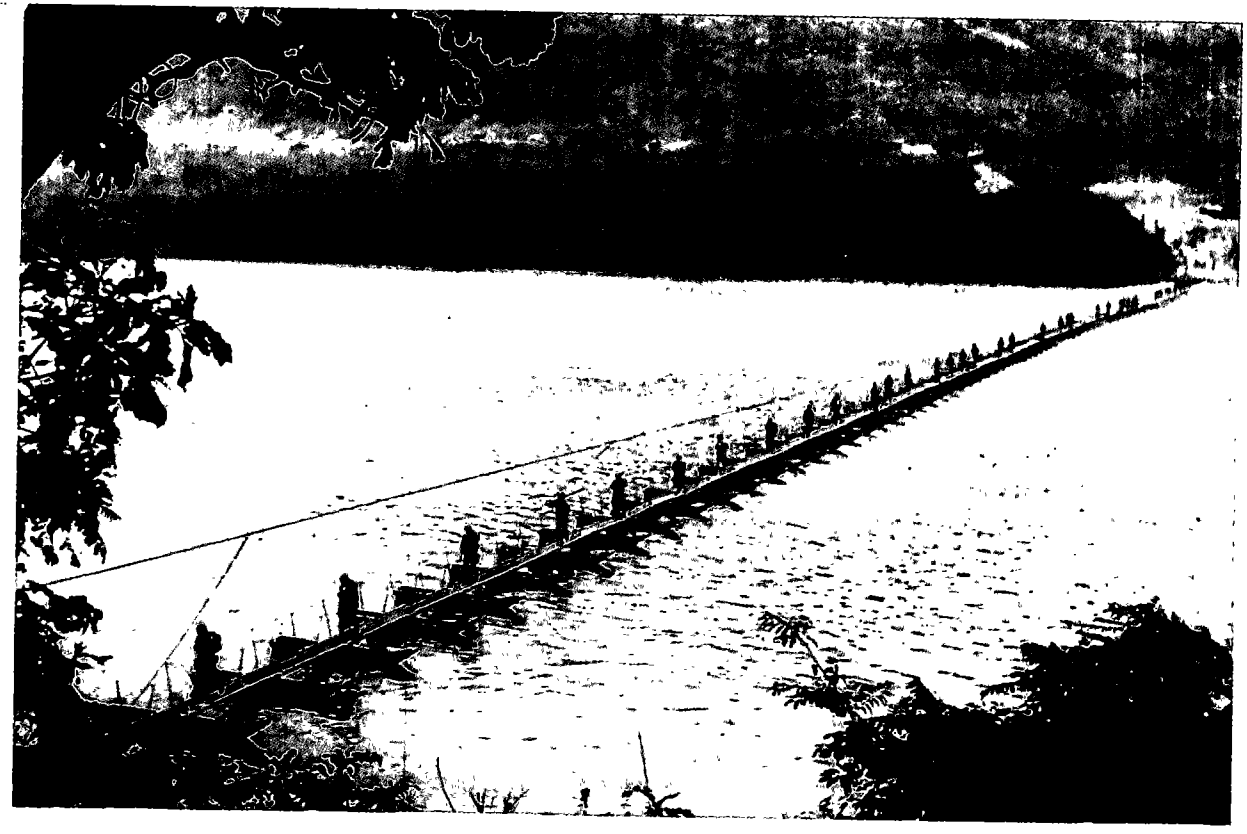

Figure 9. Aluminum footbridge.

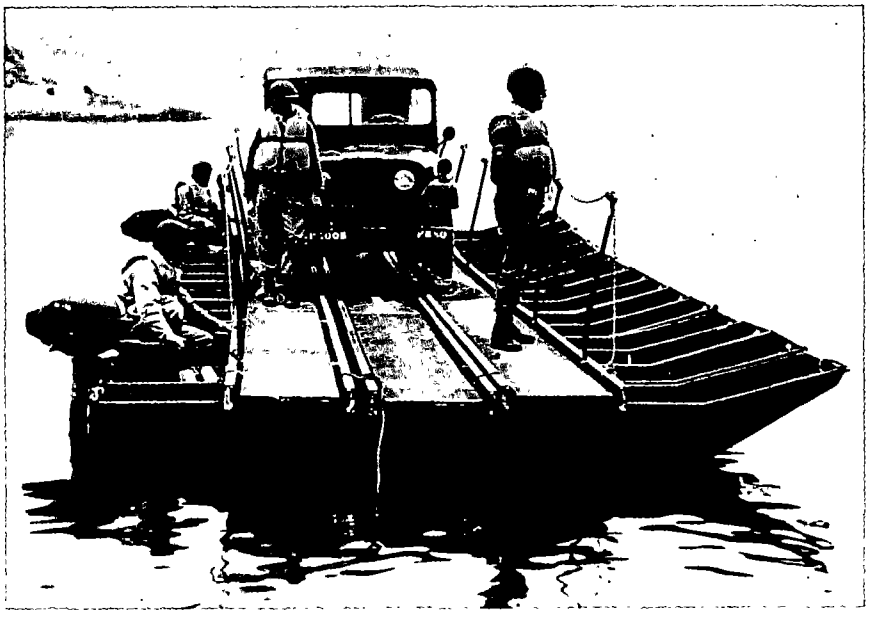

Figure 10. Aluminum footbridge raft.

3. Footbridges

a. General. For use and characteristics, see table III.

b. The aluminum footbridge (fig. 9) can be employed safely in currents up to 11 feet per second. One set of aluminum footbridge contains 144 meters of bridging and is transported on two 2½-ton cargo trucks and two 2½-ton utility pole-type trailers.

c. The aluminum footbridge components can be assembled as a bridge or raft (fig. 10) for transport of ¼-ton vehicles and other loads of similar weight.

4. Rafts

For types, use, and characteristics see Table III.

a. Light Tactical Raft. See figure 11.

b. M4T6 Raft. See figure 12.

c. Class 60 Raft. See figure 13.

d. Mobile Assault Raft. See figure 14.

e. M4 Raft. See figure 15.

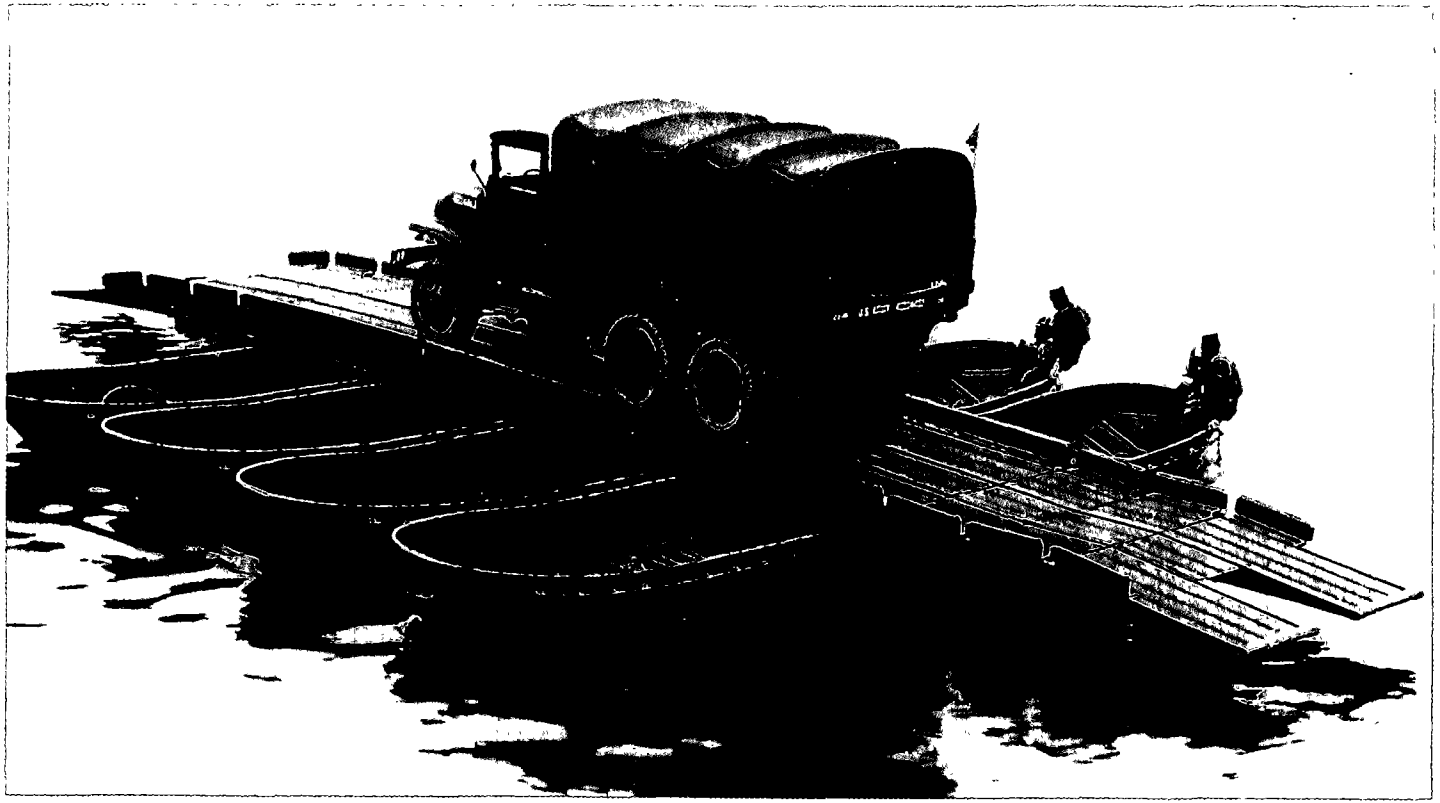

Figure 11. Light tactical raft.

Figure 12. M4T6 raft.

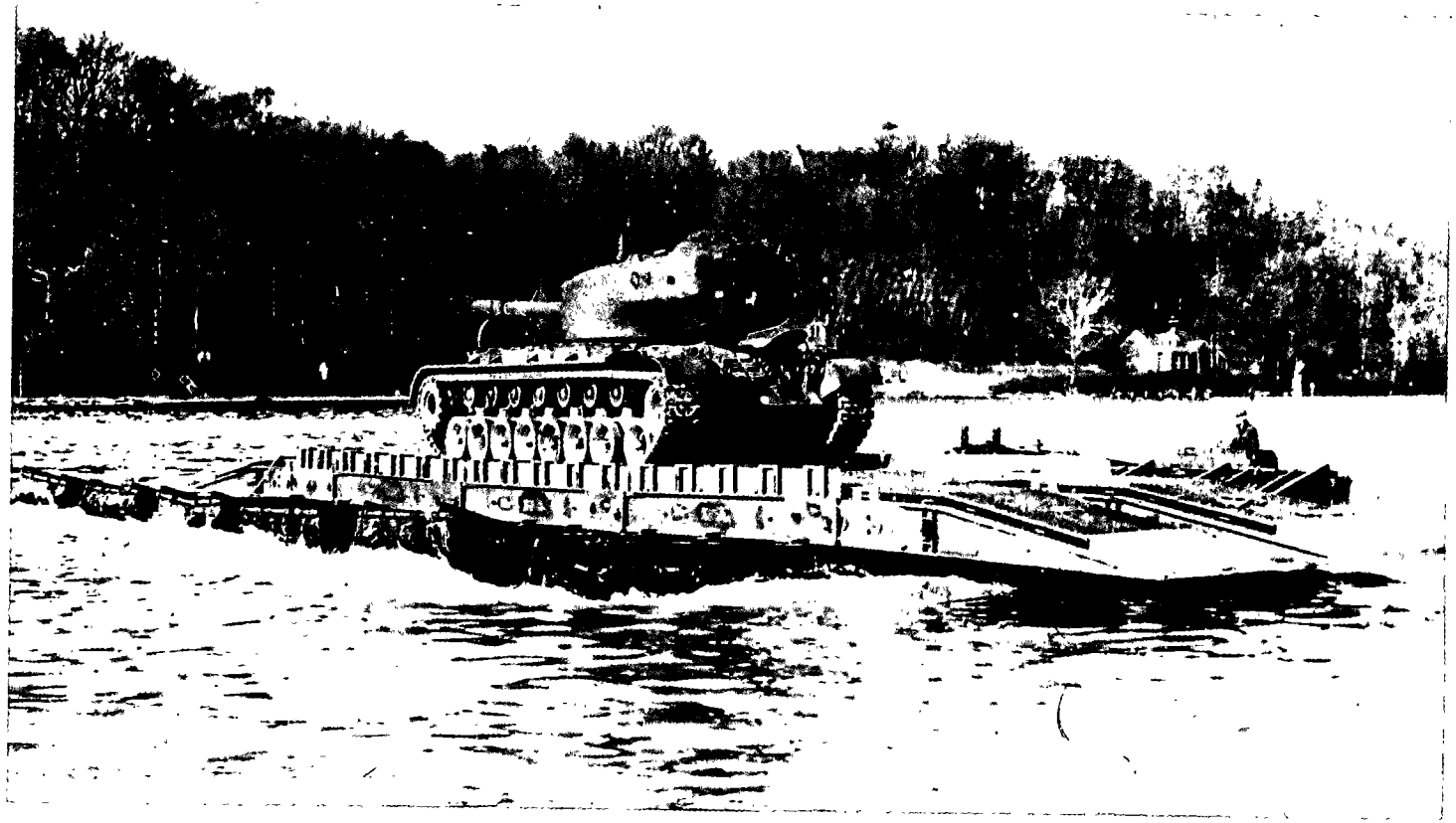

Figure 13. Class 60 raft.

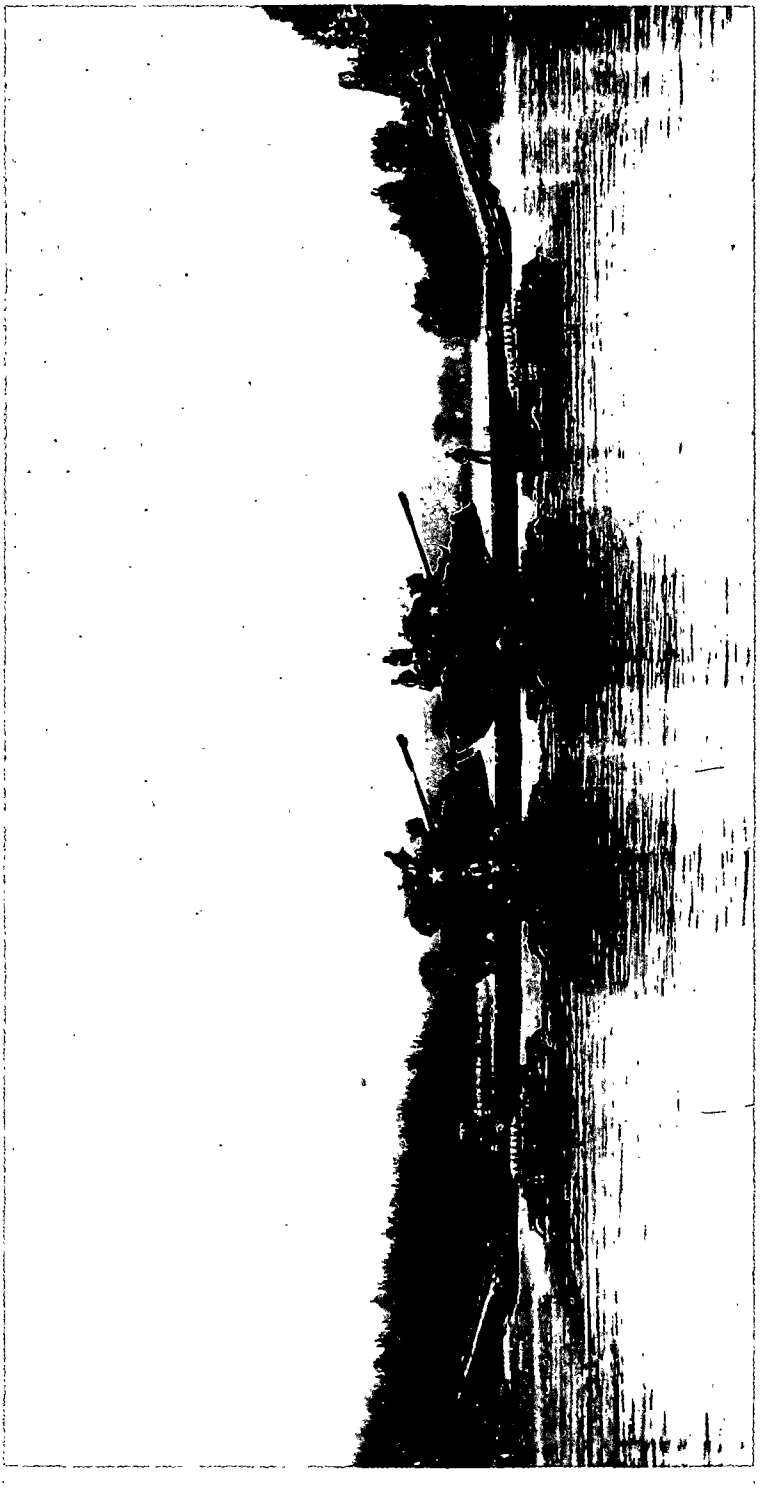

Figure 14. Mobile assault raft.

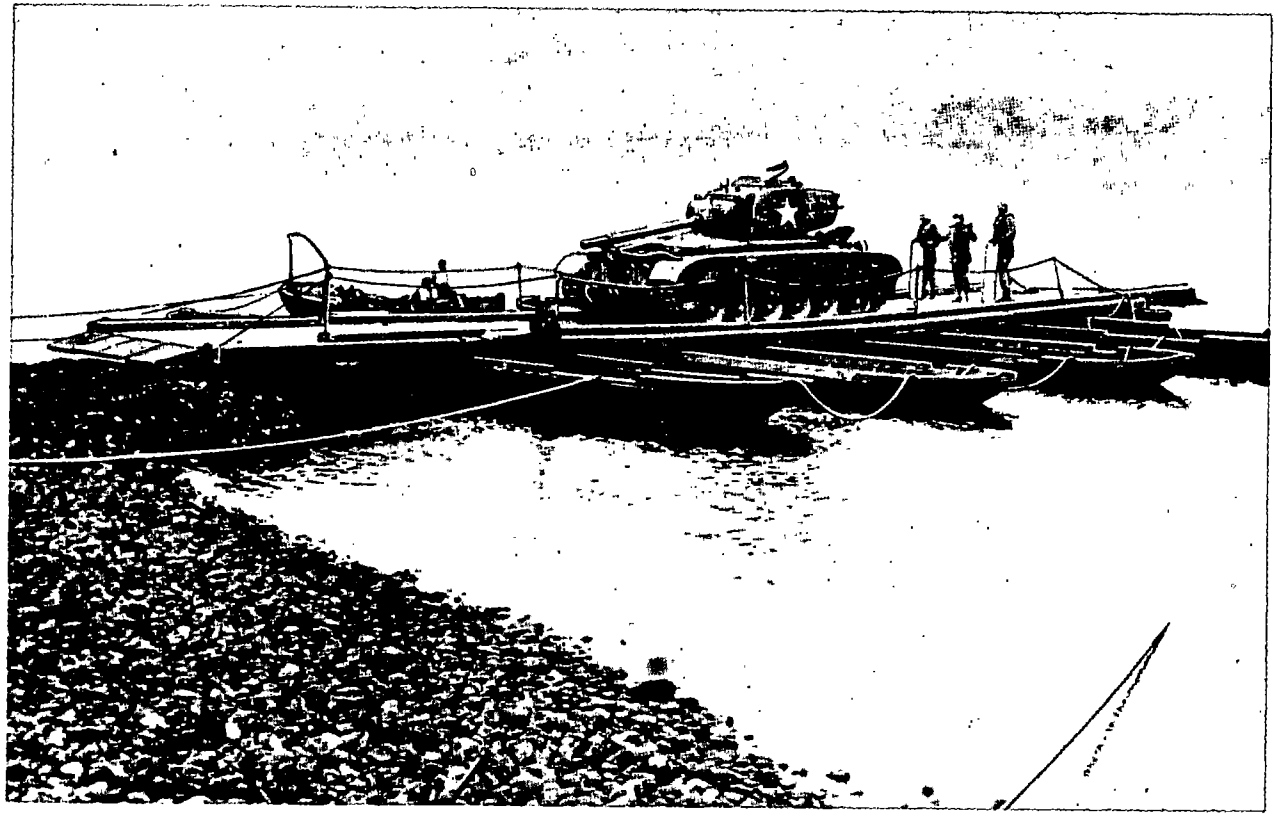

Figure 15. M4 raft. (limited standard)

f. Advantages. Rafts can be used in the early stages of the assault to cross high-priority vehicles and equipment, for example tanks and artillery, prior to the time bridges are placed in operation. After bridges are operating, rafts are used to supplement the carrying capacity of bridges and to handle traffic when bridges become inoperative. Rafts may also be used to evacuate casualties from the far shore while bridges are reserved for one-way traffic into the bridgehead (FM 8–35). Because of their mobility, rafts are not as vulnerable to enemy fires as bridges. Plans should provide for alternate and supplementary sites to be used when enemy action interferes with the use of the primary sites.

g. Disadvantages. Operation of multiple rafts at numerous crossing sites over a dispersed crossing front add to the engineer effort required for assembly and operation, and construction of an adequate road net to support the various raft sites. Trained crews are required to operate rafts. The depth and current of the river and the nature of the banks may limit the use of rafts. Depending upon the river width, rafting operatings may provide an inadequate volume of traffic to support rapid movement on the far bank.

Table III. Rafts
(Located at back of manual)

5. Floating Vehicular Bridges

a. General. For types, use and characteristics, see table IV.

b. Light Tactical Bridge (fig. 16). The light tactical bridge equipment can be used to assemble either rafts or floating bridges. The bridge can carry up to class 16 loads in currents not exceeding 1.8 meters per second. One set of this bridging provides 13 meters of normal bridging.

c. M4T6 Floating Bridge (fig. 17). This bridge is a standard item and is organic to float bridge companies. It may be issued to bridge companies of the infantry, armored, and mechanized divisions where mobile assault bridge equipment is not available. It consists of a continuous roadway of aluminum-alloy deck balk supported by 24-ton pneumatic floats. This bridge will provide a means for crossing divisional, corps, and army loads.

d. Class 60 Floating Bridge (fig. 18). This bridge has a flush deck 4.1 meters wide supported by 24-ton pneumatic floats. The width of the deck exceeds the ground contact width of all presently standard vehicles and provides a means for crossing divisional corps and army loads. It may be found in float bridge companies or divisional bridge companies in lieu of M4T6 bridging.

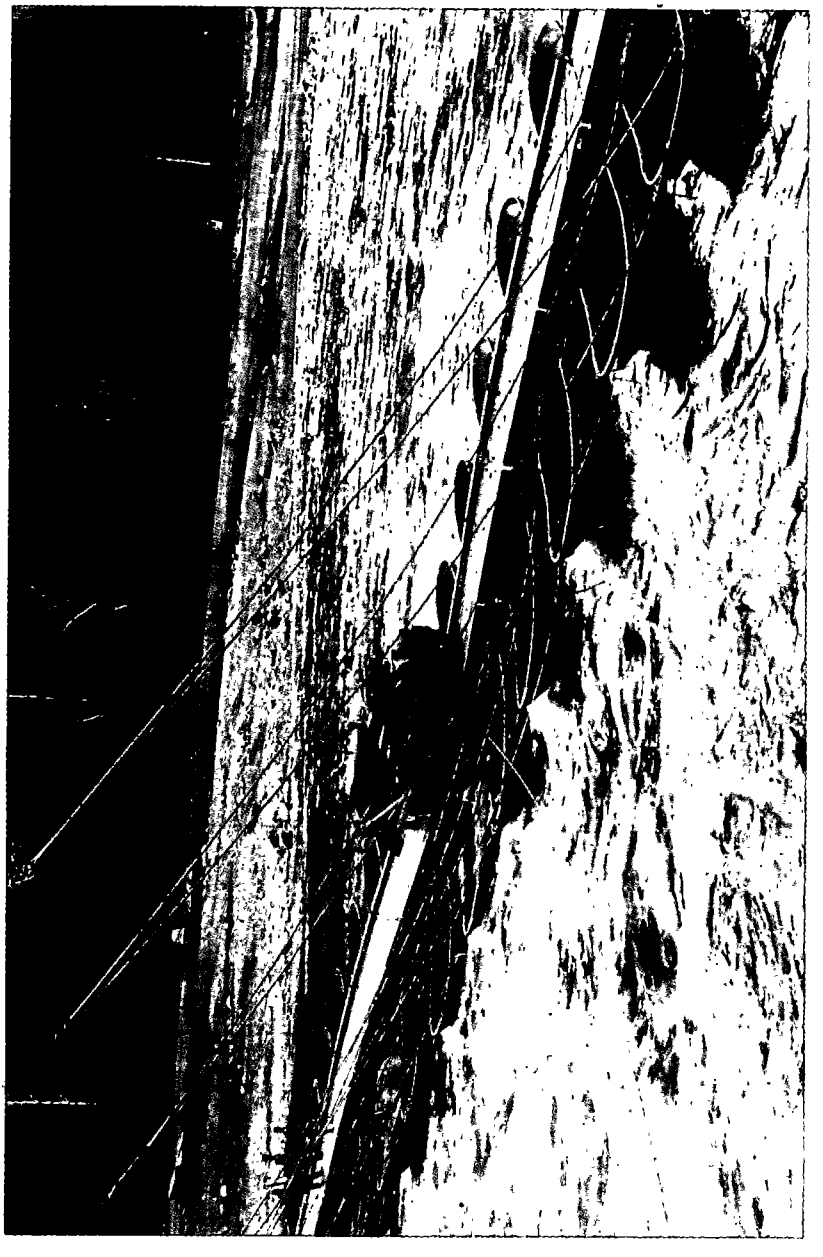

Figure 16. · Light tactical bridge.

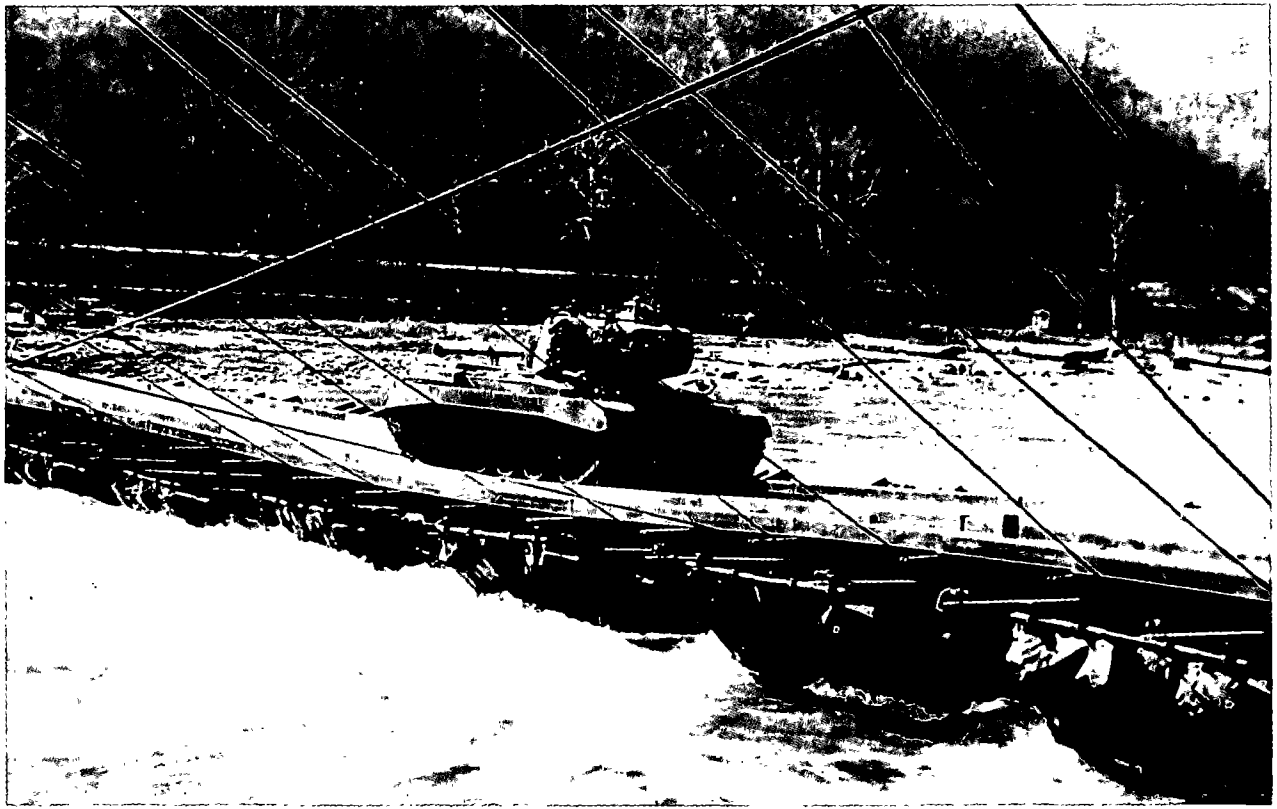

Figure 17. M4T6 bridge.

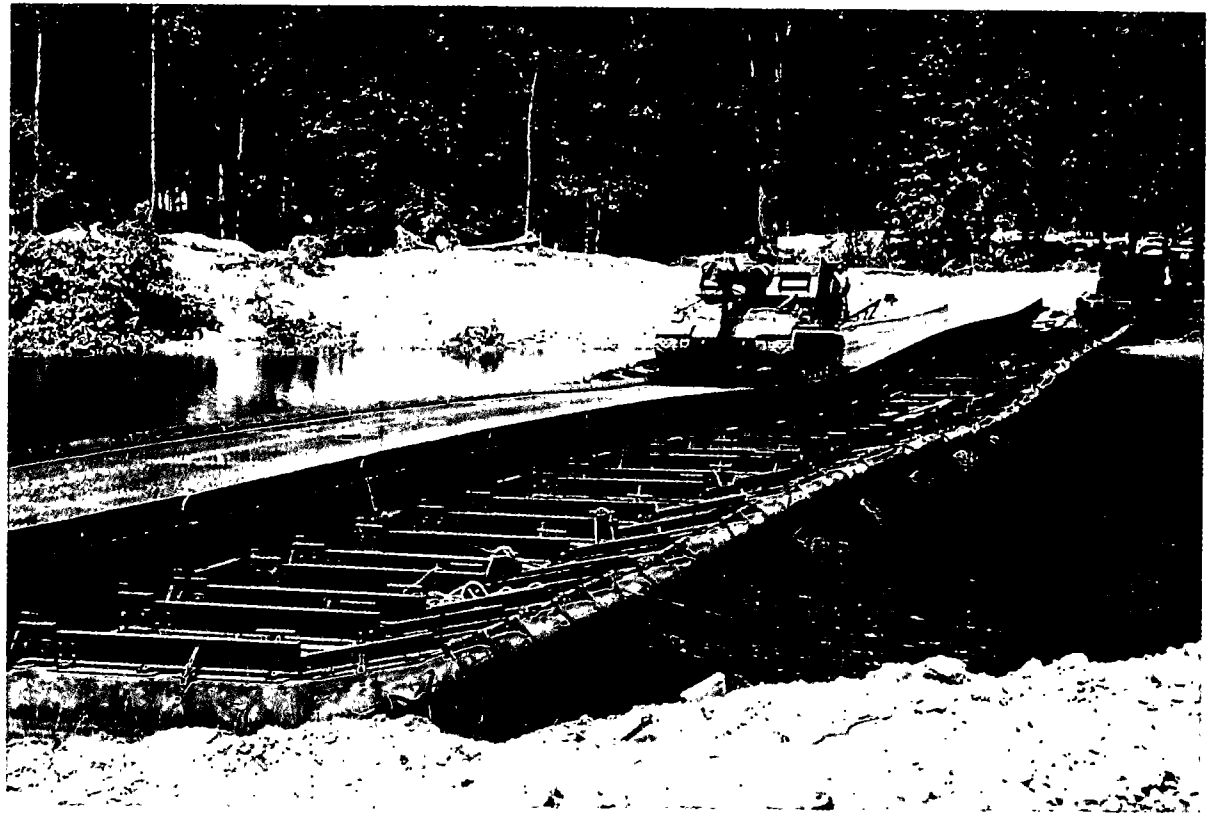

Figure 18. Class 60, floating bridge.

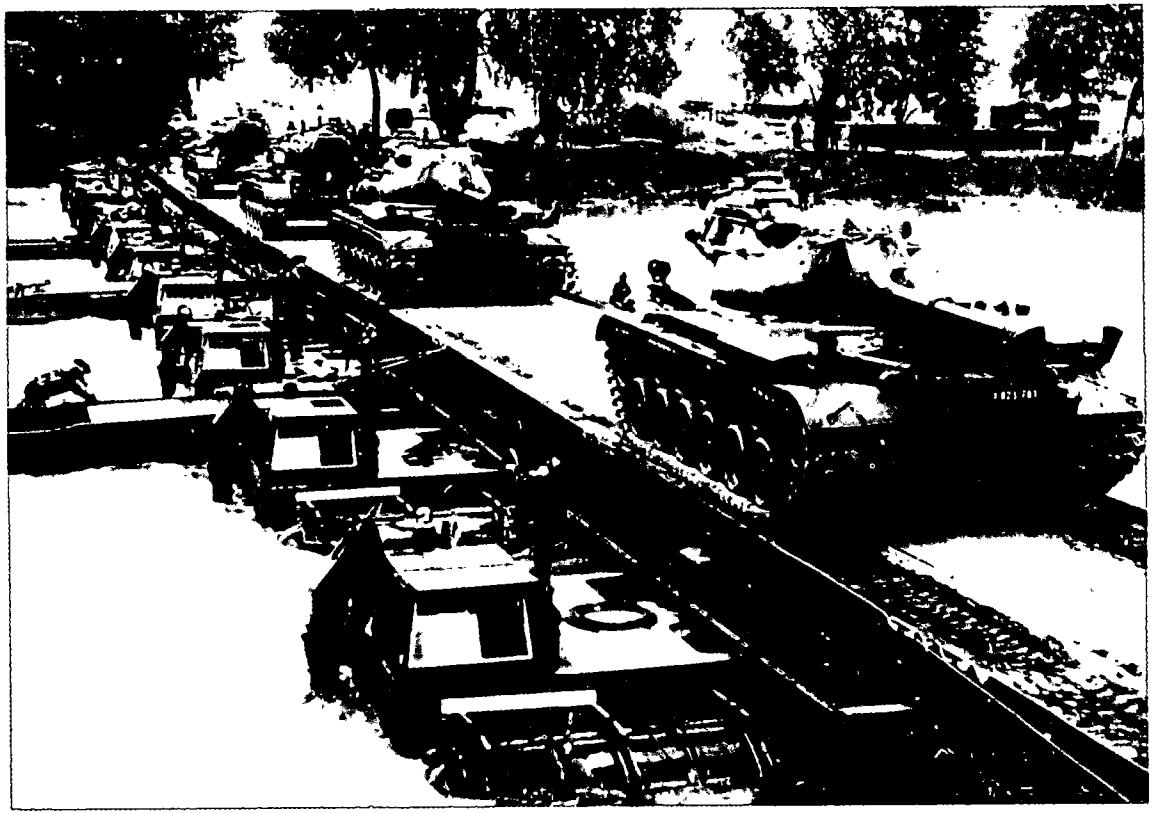

Figure 19. Mobile assault bridge.

e. Mobile Assault Bridge (fig. 19). The mobile assault bridge can be used to assemble either rafts or floating bridges. The bridge can carry up to class 55 loads in stream velocities up to 2.4 meters per second. The bridge company of the armored, infantry, and mechanized divisions and army mobile assault bridge companies will be equipped with this type bridging. Each bridge vehicle constructs 12 meters of normal bridging.

f. M4 Floating Bridge (fig. 20). This bridge is limited standard. It consists of a continuous roadway of aluminum alloy deck balk supported by aluminum pontons. Shore connections are made by resting the end balk upon abutment sills on the banks or by using one or more trestle spans. Balk are pinned to removable ponton gunwales, permitting pontons to be replaced without disturbing the bridge deck.

Table IV. Floating Bridges
(Located at back of manual)

6. Armored Vehicle Launched Bridge
(Fig. 21)

This is a 18.3 meter span crossing device capable of handling all divisional loads. It is organic to the tank and division engineer battalions of all divisions except the airborne.

7. Panel Bridge, Bailey Type, M2
(TM 5–277)

a. Types of Structure.

(1) *General.* Panel-bridge equipment can be used to build fixed bridges and panel crib piers and towers. Other special structures such as suspension bridges, retractable bridges, and mobile bridges, can be built using special parts.

(2) *Normal construction.* Panel-bridge equipment normally used to erect fixed simple-span, single-lane, through-type bridges from 9 to 64 meters long. The bridge can be assembled to meet varying conditions of span and load.

(3) *Special construction.*

(*a*) *Bridges.* Panel-bridge equipment also can be used to build two-lane, through-type bridges, single-lane, or two-lane deck-type bridges, railway bridges, and bridges on piers. It can also be used as the superstructure for floating bridges using navy cubes, barges, or other expedient floats.

(*b*) *Piers.* Panel-crib piers and towers up to 21.3 meters high can be built with panel-bridge equipment and special crib-pier parts.

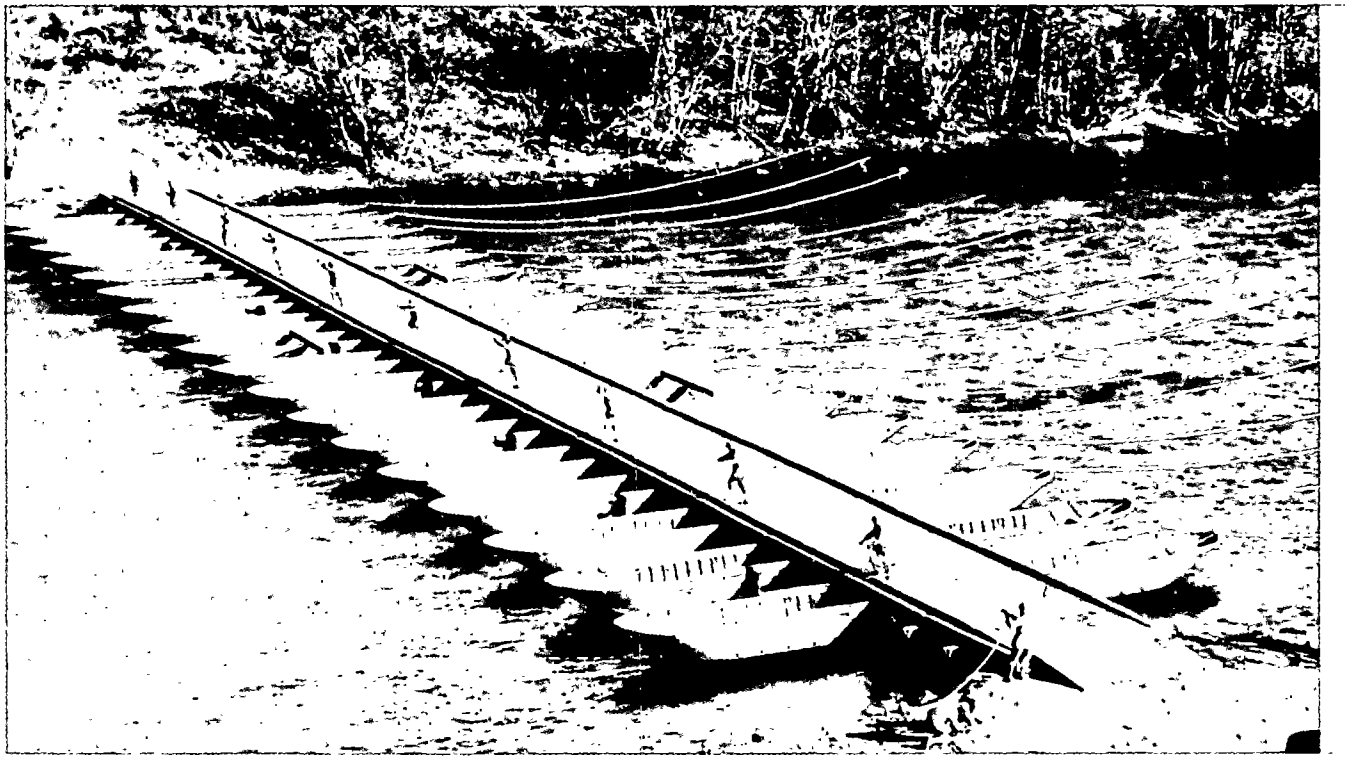

Figure 20. M4 floating bridge (limited standard).

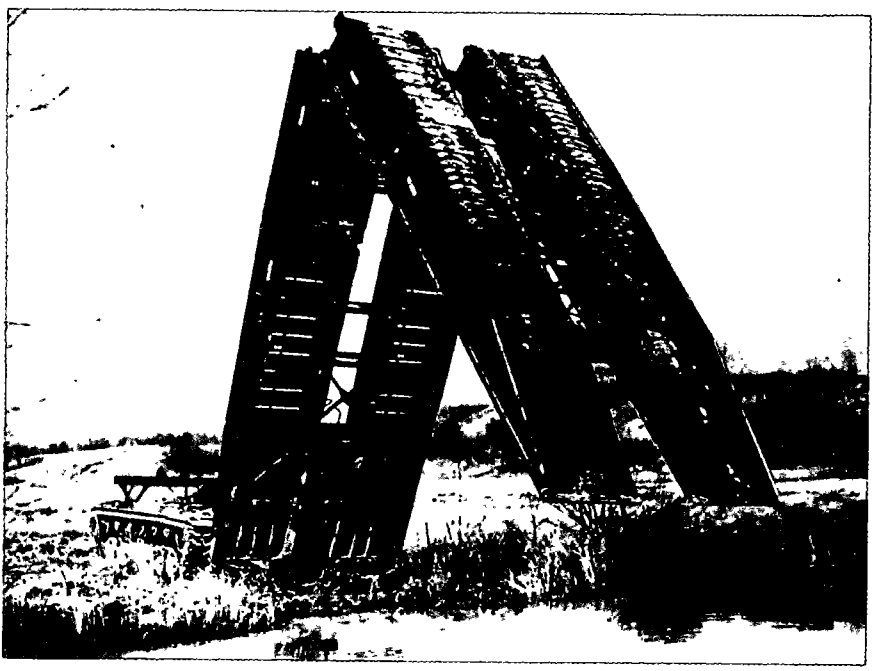

Figure 21. Armored vehicle launched bridge.

(*c*) *Expedients.* Panel-bridge equipment also can be used in whole or in part to build many structures, such as causeways, box anchors, towers for floating-bridge cables, loading hoppers, and gantries.

b. Situations.

(1) *General.* The panel bridge is used to carry both division and army loads as a tactical bridge. It may be used in the assault, in the buildup, or as a line of communications bridge.

(2) *Tactical.*

(*a*) *Initial assault.* For the initial assault, the panel bridge generally is not used except in special situations.

(*b*) *Build up.* The fixed simple-span panel bridge is used most often for the buildup. However, when a long, simple-span bridge is needed, it is sometimes more economical of time and material to build a bridge on piers, especially if partially demolished piers already exist.

(3) *Line of communications.* The panel bridge is an excellent line of communications bridge. It can be built as a through-type bridge, and as a fixed deck-type bridge.

8. Short Gap Fixed Spans

The M4 decking on the M4 and the M4T6 bridge and class 60 decking can be used to span short gaps (table V).

a. Capacity of M4 decking for short fixed spans.

Table V. Short Fixed Spans

Type of crossing	Capacity for specified span length (meters) and ratio of deck/roadway widths														
	7.1	9.1			11.7				13.7						
	22/18	22/18	22/16	24/18	22/18	22/16	24/18	26/18	20/16	22/18	22/16	24/18	24/16	26/18	26/16
Normal	120*	85	90	90	45	50	55	65	24	24	30	30	40	40	45
	100	65	70	70	35	40	45	50	25	25	30	30	35	35	40
Caution		100	100	105	70	70	75	82	40	46	46	51	51	56	56
		80	80	85	51	51	55	50	35	40	40	43	43	46	46
Risk		110	110	115	78	78	85	90	47	54	54	60	60	66	66
		90	90	95	57	57	62	67	40	45	45	49	49	53	53

*Limited by roadway width
Wheeled vehicle class/tracked vehicle class

22 Total width of bridge in number of balk
18 Total width of roadway in number of balk

b. Capacity of class 60 decking for short fixed spans.

Types of crossings	Capacity for specified clear span (meters)										
	7.3	7.9	8.5	9.1	9.8	10.4	11.0	11.6	12.2	15.2	18.3

Normal	120* 100*	120* 95	115 80	105 65	95 60	85 55	75 50	65 45	60 40	30 30	20 22
Caution	120* 100*	120* 100	120* 87	110 75	105 70	90 63	81 58	75 53	68 50	36 36	22 25
Risk	120* 100*	120* 100*	120* 100	120* 90	120 85	110 75	100 68	90 65	83 60	50 45	28 30

*Limited by roadway width

Wheeled vehicle class/tracked vehicle class.

9. Amphibious Vehicles

a. Types. Types of amphibious vehicles include—

(1) Landing Vehicle, Tracked, MK 4.
(2) Landing Vehicle, Tracked, Personnel, Model 5.
(3) Landing Vehicle, Tracked, Howitzer 6 (Amphibious Tank).
(4) Landing Vehicle, Tracked, Personnel, Model 6.
(5) Amphibious Truck, 2½-ton.
(6) Lighter, Amphibious, resupply, cargo (LARC), Model 5.
(7) Lighter, Amphibious, resupply, cargo (LARC), Model 15.
(8) 60-ton Barge Amphibious resupply, cargo BARC.
This vehicle, due to its size and weight (62½ feet in length and 198,500 pounds), has a limited use in river crossing operations. It may be used, under favorable conditions on large rivers to build up stocks of supplies on the far shore.
(9) Armored Carrier, M59 (fig. 22).
(10) Armored Carrier, M113 (fig. 23).

b. Limitations. Amphibious vehicles require landing places of a suitable gradient and with a firm bottom for entering or leaving the water. The landing places must be wide enough to allow amphibious vehicles to land even though subjected to the lateral force of the stream current. Amphibious vehicles can be preloaded and do not require a multiplicity of operations such as carrying and launching, but their use depends on availability of suitable entrances and exists to and from the river and on moderate stream currents. Their noise of operation may limit their use in the early phase of the attack.

c. Technical Characteristics. See FM 31–12, TM 9–2300–203–12, and TM 9–2300–224–10.

10. Landing Craft

a. Types. Landing craft which may be used in a river crossing include—

(1) Landing craft mechanized, Mark 6.
(2) Landing craft mechanized, Mark 8.
(3) Landing craft vehicle, personnel (LCVP).

b. Technical Characteristics. See FM 31–12.

11. Army Aviation

a. For detailed capabilities and characteristics of Army aircraft see chapters 22 and 23, FM 57–210 and paragraph 7.43*b*, FM 101–10, Part I.

b. Airmobile units are used to seize objectives that dominate the crossing sites in the attack of a river line. For a detailed discussion see paragraph 78, FM 57–35.

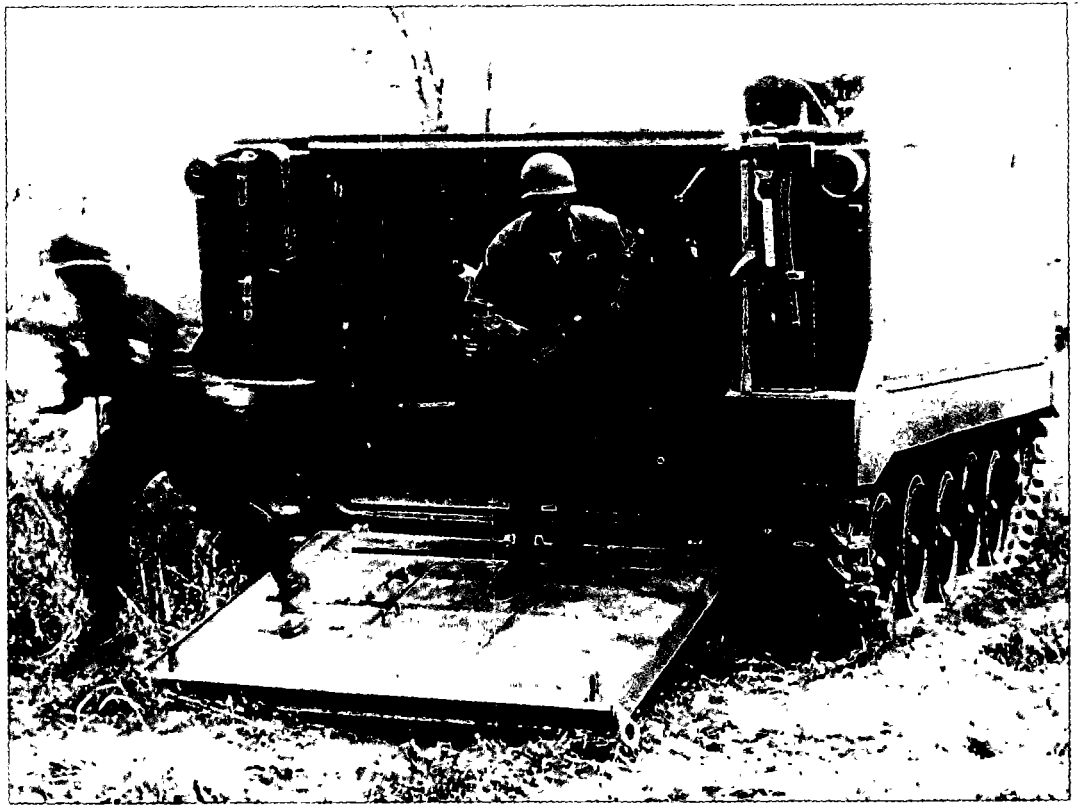

Figure 22. Armored carrier, M59.

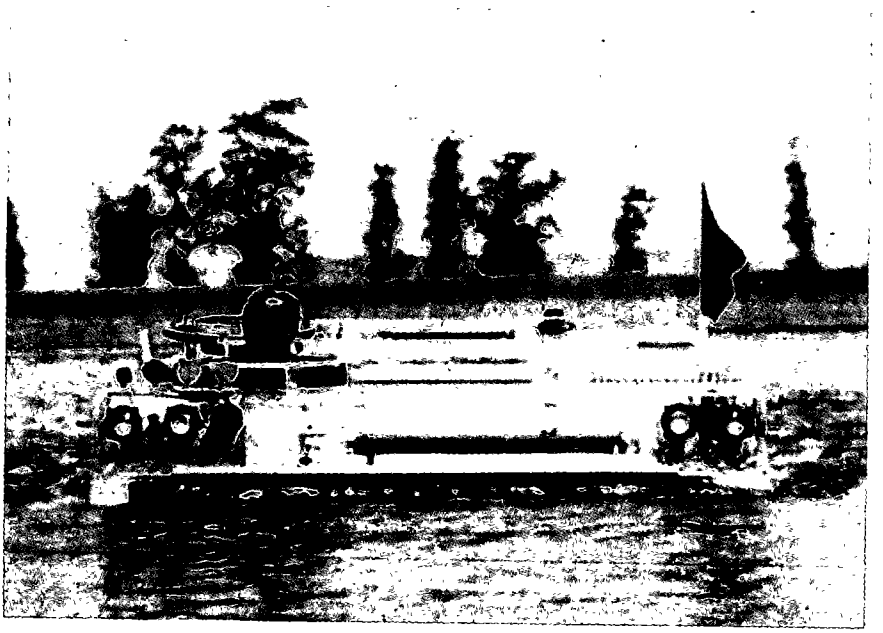

Figure 23. Armored carrier M113.

APPENDIX III

EXAMPLE TRAINING PROGRAM

(Classification)

20th Inf Div
EAST SPRINGFIELD, NY, (WC1542)
261000 Jul ___

TRAINING PROGRAM
(From 28 Jul to 6 Aug)

TM 9
Reference: Map, NEW YORK, 1:25,000, EAST SPRINGFIELD

1. INFORMATION

This division conducts river crossing training in the OTSEGO Lake area in preparation for the MOHAWK River crossing.

2. GENERAL PLAN

The training objective for this period is—

a. To train assault units in a river crossing employing amphibious vehicles and Army aviation.

b. To familiarize vehicle drivers with stream crossing means.

c. To train selected individuals and units in special operations.

d. To rehearse units for actual crossing.

3. DETAILED PLANS

a. The following subjects are to be covered:

(1) Common instruction.

(*a*) Training vehicle operators in loading, crossing, and unloading on light tactical rafts and heavy rafts.

(*b*) Training amphibious vehicle operators in entrance, crossing, and exit from the river.

(*c*) Instruction in traffic control measures.

(*d*) Transportation of patients and loading and unloading of litter patients on river crossing vehicles.

(*e*) Operations in smoke haze.

(*f*) Operations using artificial illumination.

(2) Infantry training.

(*a*) Organization for combat.

(*b*) Loading into and crossing in amphibious vehicles.

(*c*) Loading, flight, and unloading from Army aircraft.

(Classification)

(*d*) Organization and training of a task force for conduct of a feint.

(*e*) Complete rehearsals for assault battalions and brigades.

(3) Artillery training.

(*a*) Training in loading, crossing, and unloading of artillery pieces on rafts, in amphibious vehicles, and by Army aircraft.

(*b*) Forward observers will participate in training with assault battalions.

(*c*) Crossing amphibious artillery.

(4) Tank training—loading, crossing, and unloading tanks on heavy rafts.

(5) Engineers.

(*a*) Use of improvised road mats.

(*b*) Construction and maintenance of engineer crossing means.

(*c*) Develop loads for hand carry of essential tools and supplies pending crossing of special engineer vehicles.

(*d*) Route maintenance, entrances and exits to sites.

(*e*) Training of demolitions teams for underwater operations and clearance of obstacles on far bank in support of the assault.

(*f*) Operation of engineer amphibious vehicles.

(6) Signal—prepare appropriate plans and develop methods of laying underwater cable and connecting it with division wire net.

(7) Chemical—develop suitable smoke screens for near- and far-shore operations.

(8) Intelligence and security training—USASA support units will participate.

(9) Logistical support—develop procedures for the supply of ammunition, gasoline, high priority supplies, medical service and the evacuation of casualties, prisoners of war, and civilian internees by aerial and surface means.

b. Organization for training. Training will be by brigade.

c. Schedule for use of training sites. (Omitted.)

4. ADMINISTRATIVE INSTRUCTIONS

a. Equipment available for use at training sites:

Amphibious Vehicles	12
Light Tactical Rafts	8

Heavy Rafts	4
Helicopters	6

b. The minimum vehicles and equipment will be used in training.

SMITH
Major General

Distribution: A
OFFICIAL:
/s/ FOSTER
G3

APPENDIX IV

EXAMPLE ANNEXES TO DIVISION PLANS AND THE PLANNING SEQUENCE

1. Example annexes to division plans are shown below:

a. Operation Plan.

Annexes: A—Task organization
B—Intelligence
Appendix 1—Intelligence estimate
Tab A—Analysis of area of operations
Inclosure 1—Weather forecast and light data
Inclosure 2—Topographic areas overlay
Inclosure 3—Relief and drainage overlay
Inclosure 4—Trafficability overlay
Tab B—Enemy dispositions overlay
Appendix 2—Tactical air reconnaissance
Tab A—Air photo reconnaissance overlay
Tab B—Visual air reconnaissance overlay
Appendix 3—Counterintelligence plan
C—Operation overlay
D—Fire support plan
Appendix 1—Air fire plan
Appendix 2—Artillery fire plan
Tab A—Position areas and zones of fire
Tab B—Artillery fire plan
Tab C—Counterbattery plan
Appendix 3—CB plan
Appendix 4—Smoke plan
E—Engineer
Appendix 1—Assault crossing, raft and bridge sites overlay
Appendix 2—Allocation of engineer equipment and supplies
Appendix 3—Schedule of engineer tasks
F—Crossing plan
G—Road movement plan
Appendix 1—March overlay
Appendix 2—March table
H—Air movement plan
Appendix 1—Flight route diagram

I—Signal (communications plan)
Appendix 1—Teletypewriter traffic diagram
Appendix 2—Telephone traffic diagram
Appendix 3—Radio nets
Appendix 4—Messenger and air courier schedule
Appendix 5—Emergency and/or supplementary communications
K—Rear area security
Appendix 1—Antimechanized and antiairborne defense plan
Appendix 2—Antiguerrilla defense plan
L—Tactical cover and deception plan
M—Electronic warfare and signal security plan

b. Administrative Plan.

Annexes: A—Traffic regulation (circulation) plan
B—Traffic control plan
C—Aerial resupply plan
D—Civil affairs plan

2. Even though many of the plans required are prepared concurrently, the following sequence is indicative as to the order of preparation:

		Responsible officer
a.	Intelligence plan	G2
b.	Operation plan	G3
c.	Fire support plan	Division artillery commander
d.	Engineer plan	Division engineer
e.	Crossing plan	G3
f.	Road movement plan	Division transportation officer
g.	Air movement plan	Division aviation officer
h.	Signal plan (communications plan)	Division signal officer
i.	Rear area security plan	G3
j.	Tactical cover and deception plan	G3
k.	Electronic warfare and signal security plan.	Division signal officer and USASA representative
l.	Admin plan	G4
m.	Traffic regulation (circulation) plan.	Division transportation officer
n.	Traffic control plan	Division provost marshal
o.	Aerial resupply plan	G4
p.	Civil affairs plan	G5

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Air movement	70–72	34
Air support	45	23
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Joint Svc Sch (5)

NG: None.

USAR: Same as active Army.

For explanation of abbreviations used, see AR 320–50.

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	1	2	3		4	5	6	C	
								Norm	
1.	Type of raft	No of pontons or floats	Length (meters)		Construction time (min)[2]	Construction party (No men)	Operating crew (No men)	Strea (meters	
			Overall incl ramps	Available for loading[1]				1	1.6
2.	Light Tactical Raft (w/o articulators)	4 (3 bay)	19.0	13.8	30	3 and 27	1 and 13	1/16	1/16
		5 (5 bay)	22.6	16.7	35			1/16	1/16
		6 (5 bay)	26.2	21.0	40			1/18	1/18
3.	Class 60	4 Normal	30.3	17.7	[6]70 [7]30	[6]4 and 38 [7]2 and 18	1 and 12	1/45	1/45
		5 Partially Reinf	32.1	18.7	[6]80 [7]35			1/60	1/60
		6 Reinf	30.3	20.0	[6]90 [7]50			1/75	1/75
4.	M4[5,8] (limiteo standard)	4	28.6	16.9	[6]70	4 and 30	1 and 12	1/55	1/55
		6 Reinf	28.6	16.9	[6]80			1/75	1/75
		7 Reinf	28.6	16.9	[6]85			1/90	1/90
5.	M4T6[8]	4	28.6	16.9	90	4 and 42	1 and 12	1/55	1/55
		5 Reinf	29.1	16.4	100			1/65	1/65
6.	Mobile Assault Raft	2	34.4	18.5	15	None[9]	1 and amphibious vehicle crews	50	50
		3	43.1	27.1	20	None[9]		65/90	65/90
		4	51.8	35.8	25	None[9]		65/120	65/120

	1		2	
1.	Type of bridge		Float bridges in meters	
2.	Footbridge, aluminum		3.7	1
3.	Light tactical bridges		3.6	1
4.	M4T6[13] float bridge	Normal	4.9	2
		Reinforced	3.3	2
5.	Class 60 floating bridge	Normal	4.9	1
		Reinforced	3.3	1
6.	M4 floating bridge (limited atandard)	Normal[11]	4.9	1
		Rein-forced[12]	2.5	1
7.	Mobile asaault bridge		8.6	1

[1]Trensportation for bridge equipment only.

[2]Includes unloading and assembly only in encboreges. Doee not include conversion frc bridge units. Time is based on use of traine

[3]Averege for treined troopa and continuous longer spens.

[4]Based on ebutments et levele within 12-i

[5]Vehicle anywhere on bridge deck between specing, 30 metere.

[6]Center of vebicle within 12 in of bridge c eccelereting, or gear shifting.

[7]Center of vehicle within 9 in of bridge ce stopping, accelerating, or gear shifting.

[8]Treffic cepacities are for all traffic movin

Table III. Rafts

7						8	9		Operating characteristics of rafts	Stream width (meters)		
nd number of power units needed[3]												
sing		Risk crossing										
city cond)		Stream velocity (meters per second)				Type of power unit required	Transportation required (For raft equipment only. Additional needed for const equip and trps)			75	150	300
3	3	1	1.6	2.3	3		No units	Unit	No of round trips per hr in currents of 1.6 mps in daylight (reduce 50 percent for night or adverse conditions)	10	6	4
									No of rafts which can be used efficiently at one time	1	2	3
3	3 8	1 20	2 20	3 20	4 12	25 hp outboard motor	2	2½-ton cargo truck with 2½-ton pole trailer				
3	3 8	1 19	2 19	3 17	4 15		2					
4	4 18	1 22	2 22	4 22	4 22		2					
1	2 40	1 55	1 55	1 55	2 50	27-ft bridge erection boat[4]	5	5-ton bridge truck				
2	2 50	1 70	1 70	2 70	2 60		6					
2	3 65	1 90	1 90	2 90	3 80		6					
1	1 55	1 60	1 60	1 60	1 60	27-ft bridge erection boat[4]	5	2½-ton bolster truck with 2½-ton bolster trailer				
1	2 70	1 80	1 80	1 80	2 80		6					
1	2 85	1 95	1 95	1 95	2 95		7					
1	2 40	1 65	1 65	1 60	2 50	27-ft bridge erection boat[4]	5	5-ton bridge truck				
2	3 60	1 75	1 75	2 75	3 70		5 1	5-ton bridge truck 2½-ton cargo truck				
-	- 35	- 60	- 60	- 53	- 45	Self contained power in amphibious bridging units	2	Amphibious bridge vehicles plus 2 amphibious ramp carriers or 1 5-ton tractor with 25-ton low bed trailer				
)	45	75 90	75 90	68 90	55		3					
)	50	78 120	78 120	72 120	65		4					

[1]Measured from outside edge to outside edge of end pontons or float saddle beams, except mobile assault ferry which is measured from ramp joint to ramp joint.

[2]Construction time includes unloading and assembly only, does not include preparation of landing sites or construction of access roads. Times are based on use of trained personnel and no delays.

[3]Capacities are based on loading rafts with center of gravity of loads 6 inches downstream of raft centerline and on properly inflated floats, or conversion from highway travel condition to water entry configuration for mobile assault ferry.

[4]One 19-ft bridge erection boat may be used in currents not over 1.6 mps. In 1.6 mps currents and over, two 19-ft boats may be substituted for one 27-ft boat.

[5]Extreme caution is required in loading and unloading vehicles weighing more than 60 tons.

[6]Truck-crane or equivalent required for assembly time.

[7]Complete bays preassembled in rear area and launched directly from transporting trailer into water at assembly site.

[8]Roadway width consists of 18 bulk between curbs in 22 bulk deck.

[9]Exclusive of amphibious vehicle crews.

Key

No of power units needed
Capacity class (one or more vehicles)

No of power units needed
Single vehicle capacity
Double vehicle capacity (Approx equal in weight)

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Table III.

Table IV. Float Bridges

3	4				5		6	7															8
	Construction time in hours[2]				Construction party (No men)[3]		Maint crew (No men)	Load classes[4]															
								Safe crossing (posted capacity)[5]					Coution crossing[6]					Risk crossing[7]					Traffic capacity and vehicular distance for safe crossing in daylight (except as otherwise noted)[8]
ortation required[1]	Stream widths (meters)				Bridge	Abutment and anchorages		Stream velocities in meters per second (mps)															
	50	80	160	325				1	1.6	2.3	2.6	3	3.6	1	1.6	2.3	2.6	3	3.6	1	1.6	2.3	2.6	3	3.6	
ruck and 1 2½-ton ler per 77.4 meters	1/6	1/4	1/3	---	2 and 22	1 and 14	1 and 6	←		Safe		→	---	---	---	---	---	---	---	---	---	---	---	---	---	---	Day: 75 men per min Night: 40 men per min at 2-pace distance[9].
ruck and 1 2½-ton ler per 14.4 meters	1	1½	2½	---	5 and 36	4 and 28	1 and 8	16	16	13	11	8	2	18	18	15	12	9	3	21	21	17	14	11	5	400 vehicles per hr 30 meters distance between vehicles.
rucks w/pole type tlr eters of bridge.	2	3	5	10	12 and 128	3 and 30	1 and 12	55	55	50	45	40	30	60	60	55	50	45	35	70	70	65	60	55	45	400 vehicles per hr
rucks w/pole type tlr eters of bridge.								85	80	80	70	65	35	90	85	85	75	70	40	100	95	95	85	80	50	30 meters distance between vehicles.
dge truck per 4.9 f bridge.	2	3	5	10	7 and 73	3 and 30	1 and 12	65	65	10[10]55	50	45	25	70	70	60	55	50	35	80	80	70	65	60	50	400 vehicles per hr 30 meters distance between vehicles.
dge truck per 4.9 bridge and 1 2½-ton 9.8 meters of bridge.	3	4	7	12	9 and 91			85	85	75	70	65	40	90	90	80	75	70	50	100	100	90	85	80	65	
olster truck and 1 lster trailer per s of bridge.	2	3	5	10	10 and 136	3 and 30	1 and 12	60	60	50	45	35	20	65	65	55	50	45	30	70	70	60	55	50	40	
olster truck and 1 lster trailer per s of bridge.	3	4	7	12				100	100	100	85	70	40	105	105	105	95	85	55	110	110	110	105	100	70	
g veh per 8.6 brg exclusive ters ramp at ol brg & 2 ip carriers or tor w/25 ton lr.	½	⅔	1	2	None (exclusive of amphibious veh crews)	None (exclusive of amphibious veh crews and bank & access road preparation required)	None (exclusive of amphibious veh crews)	65	65	60	55	50	30	70	70	65	60	55	40	78	78	72	70	65	50	400 vehicles per hour 30 meters distance between vehicles.

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al needed for any construction equipment required, and for troops.

Does not include access roads, assembly sites, abutments, or y travel condition to water entry configuration for the mobile assault nd no delays. Average time with 2 assembly sites.

assembly. Allowances are required for specific situations and the

ing bridge deck level.

5speeds up to 40 kph permitted, but 24 kph recommended. Vehicle

. Maximum speed 13 kph. Vehicle spacing 50 meters. No stopping,

with guide. Maximum speed 5 kph. One vehicle on bridge. No

d or rearward.

[9]Reduce capacity 20 percent for currents of 3 to 3.6 mps.

[10]60-ton tanks having tread widths of 143 inches or more may cross safely up to 2.3 mps.

[11]Ratings based on use of reinforcing ponton in end span and 1 bulk between curbs (166⅔ in) in 22 bulk wide superstructure.

[12]Ratings based on use of double deck end span, 100 percent reinforced flooring section and 20 bulk between curbs (185 in) in 24 bulk wide superstructure.

[13]Ratings based on 18 bulk between curbs (166⅔ in) in 22 bulk wide superstructure.

Table IV.

Reference
FM 31-60
C 1

FIELD MANUAL

RIVER-CROSSING OPERATIONS

CHANGE No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., *27 January 1964*

FM 31-60, 18 July 1962, is changed as follows:

2. Scope

* * * * * * *

d. Users of this * * * and complete evaluation. Comments should be forwarded direct to U.S. Army **Combat Developments Command Combined Arms Agency,** Fort Leavenworth, Kansas.

4. Types of River-Crossing Operations

a. A *hasty crossing* * * * by assault forces. **Planning assures that** fire support and crossing means are **readily** available to assault force commanders on arrival at the river. Speed, surprise, and * * * hasty river crossing.

* * * * * * *

14. Sequence of Operations Planning

* * * * * * *

d. (Added) See appendix V for a sample operations order and crossing plan.

30. Assault Crossing Site

* * * * * * *

c. (Superseded) It is desirable to eliminate as many stops for traffic as possible, particularly in nuclear warfare. The necessity for occupying attack positions for any appreciable length of time is weighed against the enemy's target acquisition and delivery capabilities.

33. Number and Type Sites Required

* * * * * * *

c. (Added) See appendix V for an example of the tactical and technical evaluation of crossing sites.

65. Communications for Traffic Control

Initially, traffic control * * * across the river. Radio relay **and radio/wire integration** systems should be installed across the river as soon as the tactical situation permits.

67. Unit Serials

* * * * * * *

b. (Superseded) When the crossing plan for the surface elements provides for two or more bridges per crossing division, the allocation of a combined priority for all serials capable of crossing these bridges should be made. This insures the overall order of movement across the remaining bridge or bridges should one of the bridges be damaged or destroyed.

72. Air Movement of Airmobile Forces

a. Army aircraft provide the commander with a means of airlifting tactical elements of his command to increase the rate of troop buildup in the bridgehead, to expedite support or evacuation, and to extend combat **support** and **combat service** support dispersion.

* * * * * * *

APPENDIX II
CROSSING EQUIPMENT

Table III. (Superseded) *Rafts*

(Located in back of manual)

5. Floating Vehicular Bridges

* * * * * * *

e. Mobile Assault Bridge (fig. 19). The mobile assault * * * this type bridging. Each bridge vehicle constructs 8 meters of normal bridging.

* * * * * * *

Table IV. (Superseded) *Float Bridges*

(Located in back of manual)

APPENDIX V
DEVELOPING A CROSSING PLAN
(ADDED)

1. General

This appendix describes one method by which a division crossing plan may be developed. The hypothetical 20th Infantry Division has been used in the examples; however, the same procedures are applicable to other types of divisions. The details and format should be varied, as required, to suit the existing situation.

2. Site Selection

In most river-crossing operations, the tactical and technical considerations of site selection are in conflict. For example, from a technical viewpoint, the selection of an old permanent bridge location usually offers several advantages as a floating bridge site. The access roads are simple to construct, and the piers of the old bridge can be used to anchor the floating bridge. However, from a tactical viewpoint, old bridge sites are usually heavily mined and are excellent registration points for enemy artillery. The commander must recognize the existence of this conflict, weigh existing factors, and make necessary compromises to arrive at a sound, workable solution. Tables VI and VII show a sample format that may be used in evaluating the tactical and technical aspects of crossing sites. Additions and deletions to the features listed should be made as warranted by existing conditions.

Table VI. (Added) *Evaluation of Assault Crossing Sites*

		Assault site		
		1	2	***
Access to Crossing Site (Road net [RN] and Cross Country Mobility [CCM])	Foot Troops (with Assault Boats)	RN—Fair CCM—Poor (Marshes)	RN—Fair CCM—Good	***
	APC	RN—Fair CCM—Poor (Marshes)	RN—Fair CCM—Good	***
Egress from Crossing Site	Foot Troops	RN—Poor CCM—Fair	RN—Good CCM—Good	***
	APC	RN—Poor CCM—Fair	RN—Good CCM—Good	***
Stream Velocity	Assault Boats	Fair	Good	***
	APC	Fair	Good	***

Table VI—Continued

		Assault site		
		1	2	***
Obstacles Affecting Movement	Near shore	None	None [1]	***
	Water Area	None	None [1]	***
	Far shore	None	None [1]	***
Bank (composition and slopes)	Foot troops in assault boats	Fair	Good	***
	APC	Poor—far shore requires considerable engineer work	Fair	***
Enemy Situation—far shore		Poor—enemy positions along ridge	Poor—enemy positions vicinity Hill 206	***
Assembly Areas Available		Fair	Fair	***
Attack Positions Available	Day	Poor—too far from river	Poor—little concealment	***
	Night	Good	Good	***
Avenues of Approach (to objective—far shore)		Fair—terrain good, but long	Good	***
Dominating Terrain (near shore)		Poor	Fair	***
Space for Movement		Poor—limited to North by division boundary	Good	***
Remarks and/or Recommendations		Reject. Site presents difficult problems, both tactical and technical	Select. Advisable to employ night assault or smoke attack positions	***

[1] Except vicinity of old bridge site.

Table VII. (Added) *Evaluation of Float Bridge and Raft Sites*

Feature		Site			
		***	G	H	***
Roads (Vicinity Near Shore)	Class	***	60	60	***
	Road Net	***	Good	Fair	***
Roads (Vicinity Far Shore)	Class	***	60	60	***
	Road Net	***	Good	Fair (1-way)	***
Road Construction Requirements	Near Shore	***	Repair craters	Requires 400m access road	***
	Far Shore	***	Remove mines	Remove mines, clear rubble	***
Crossing Class (on stream velocity for wheel/track)	LTR (4-pontoon)	***	12/12	12/12	***
	Mobile Assault Raft (4-float)	***	60/65 or 2 ea 60	60/65 or 2 ea 60	***
	M4T6 Raft (4-float)	***	50/55	50/55	***
	M4T6 Bridge	***	45/55	45/55	***
Obstructions (water area)		***	None	None	
Width of River (Meters)		***	98	100	***
Banks	Preparation required	***	Good	Poor—will require some gravel and revetting	***
	Support loads	***	Good	Fair	***
Equipment Erection Area	River	***	Fair	Fair	***
	Rear	***	Good	Good	***
Anchorage	Holdfasts	***	Good	Fair	***
	Bottom	***	Poor	Poor	***

Table VII—Continued

Feature	Site			
	***	G	H	***
Remarks and/or Recommendations	***	Select. Good raft or bridge site	Reject. Poor raft and and bridge site. Would require considerable effort and tie-in to only fair road net	***

3. Organizing Alternate Crossing Capabilities for Comparison

In selecting the proper crossing alternative, the number of vehicles to be crossed must be weighed against the available crossing means. Table VIII lists the vehicle raft requirements for organic and attached vehicles available at the time of the crossing. Table IX shows the available crossing means.

Table VIII. (Added) *Vehicle Raft Requirements*

Unit	Amphibious vehicles	Light tactical raft (vehicles Cl 12 or less)	M4T6 or mobile aslt (vehicles Cl 12 and over)
1st Bde, 20th Inf Div:			
Bde Hq	2	48	1
1/66 Inf	0	117	1
* * *	**	**	**
63d Arty Gp Hq	0	30	0
1/45 Arty (105)	0	121	1
1/651 Arty (155)	0	97	32
* *	**	**	**
* * *			
Fwd Spt Co, Maint Bn	0	41	3
* * *	*	**	**
Total 1st Bde	37	933	172
2 Bde, 20th Inf Div:			
Bde Hq	2	48	1
* * *	**	**	**
A 1/1 Armor	2	5	18
* * *	**	**	**
Total 2d Bde	16	636	45
3d Bde, 20th Inf Div:			
* * *			
Total 3d Bde	27	438	89

Table VIII—Continued

Unit	Amphibious vehicles	Light tactical raft (vehicles C1 12 or less)	M4T6 or mobile aslt (vehicles C1 12 and over)
Div Arty, 20th Inf Div:			
HHB	0	67	0
1/47 Arty (105)	0	121	1
* * *	**	**	**
Total Div Arty	0	601	153
Div Trp, 20th Inf Div:			
HHC	0	44	0
1/21 Cav	42	126	48
* * *	**	**	**
Total Div Trp	42	930	246
Spt Comd, 20th Inf Div:			
HHC & Band	0	19	0
* * *	**	**	**
Total Spt Comd	0	297	62
20th Inf Div Total	122	3835	767

Table IX. (Added) *Available Crossing Means*

	Recon Boats 3-man	Aslt Boats 15-man	Foot Bridge	LTR (C1 12)	M4T6	Mobile Aslt Bridge/Raft
HHC, Inf Bde (3)	3					
HHC, 20th Engr Bn	4					
Engr Co (4), 20th Engr Bn	12					
Bridge Co, 20th Engr Bn	12	18	----------	2	----------	1—144 Meter Bridge or 4—4 Float Rafts
Bridge Co, 114th Engr Gp	10	70	144 meters	6	216 meters Bridge or 10—4 Float Rafts or combination	
TOTALS	41	88	144 meters	8	216 meters Bridge or 10—4 Float Rafts or Combination	1—144 meter Bridge or 4—4 Float Rafts

Table X. (Added) *Estimated Vehicle Crossing Capability*

ALTERNATIVE	CROSSING MEANS	CUMULATIVE VEHICLES CROSSED																
		H+1	H+2	H+3	H+4	H+5	H+6	H+7	H+8	H+9	H+10	H+11	H+12	H+13	*	*	H+24	H+25
A	8—LTR (C1 12): Total round trips	0	28	84	140	196	252	308	364	420	476	532	588	644	*	*	1260	1316
	10—M4T6 Rafts (C1 55): Total round trips	0	0	0	70	140	210	280	350	420	490	560	630	700	*	*	1470	1540
	4—Mobile Aslt Rafts (C1 60): Total C1 60 vehicles	0	0	56	112	168	224	280	336	392	448	504	560	616	*	*	1232	1288
	0—M4T6 Bridges: Total number of vehicles	0	0	0	0	0	0	0	0	0	0	0	0	0	*	*	0	0
	Total Vehicles	0	28	140	322	504	686	868	1050	1232	1414	1596	1778	1960	*	*	3962	4144
B	8—LTR	0	28	84	140	196	252	308	364	420	476	532	588	644	*	*		
	5—M4T6 Rafts	0	0	0	35	70	105	140	175	210	245	280	315	350	*	*		
	4—Mobile Aslt Rafts	0	0	56	112	168	224	280	336	392	448	504	560	616	*	*		
	1—M4T6 Bridge	0	0	0	0	0	0	400	800	1200	1600	2000	2400	2800	*	*		
	Total Vehicles	0	28	140	287	434	581	1128	1675	2222	2769	3316	3863	4410	*	*		
C	8—LTR	0	28	84	140	196	252	308	364	420	476	*						
	0—M4T6 Rafts	0	0	0	0	0	0	0	0	0	0	*						
	4—Mobile Aslt Rafts	0	0	56	112	168	224	280	336	392	448	*						
	2—M4T6 Bridges	0	0	0	0	0	0	800	1600	2400	3200	*						
	Total Vehicles	0	28	140	252	364	476	1388	2300	3212	4124	*						

4. Comparison of Alternate Crossing Capabilities

a. Table X presents a comparison of the alternative crossing capabilities and gives an estimate of the number of vehicles that can be crossed per hour after the attack is launched.

b. The following intelligence and planning factors were used in developing table X:

(1) Velocity of river—1.6 meters per second.
(2) Width of river throughout crossing front—100 meters.
(3) Construction begins:
  (*a*) Light tactical raft—H+1.
  (*b*) M4T6 raft—H+1 hr 30 min.
  (*c*) Mobile assault raft—H+1 hr. 30 min.
  (*d*) M4T6 bridge—H+2 hr. 30 min.
(4) Construction times (tables III and IV):
  (*a*) Light tactical raft—30 min.
  (*b*) M4T6 raft—1 hr 30 min.
  (*c*) Mobile assault raft—25 min.
  (*d*) M4T6 bridge—3 hr. 30 min.
(5) Round trips per hour (table III):
  (*a*) Light tactical raft—7.
  (*b*) M4T6 raft—7.
  (*c*) Mobile assault raft—7.
(6) Light tactical raft (LTR) and M4T6 raft capabilities are based on one vehicle per trip (increase to two vehicles for M4T6 rafts transporting class 12 and smaller vehicles).
(7) Mobile assault raft vehicles are computed on basis of two class 60 vehicles per trip (number of vehicles can be increased by two for rafts carrying vehicles under class 12).
(8) In table X, the figures for each hour are cumulative and do not include vehicles that cross using their amphibious capabilitiy.

c. In analyzing the alternatives, the following were considered:

(1) The crossing volume provided should be sufficient to permit timely accomplishment of the mission.
(2) Amount of organic and attached engineer effort required to construct and operate the crossing means.
(3) Provision for build-up of essential vehicles and equipment in the bridgehead between the time of the assault crossing and completion of floating bridges.
(4) Vulnerability of crossing means to enemy attack.
(5) Traffic control problems created by limited crossing means.
(6) Congestion created by limited crossing means thereby presenting a lucrative target to the enemy.

d. In selecting the crossing capability best suited for this particular situation, the relative merits of raft versus bridge operation were examined. Rafts are excellent means of moving essential vehicles into the

bridgehead during the interval between the assault crossing and completion of the bridges. Essential vehicles are the vehicles considered most important to the success of the operation for the assistance they or their contents can provide for the assault force on the far bank. Some of these vehicles are—

(1) Armored vehicles.
(2) Engineer equipment for far bank tasks.
(3) Ammunition carriers.
(4) Heavy weapons carriers.
(5) Artillery forward observer vehicles.
(6) Forward air control party vehicles.
(7) Medical vehicles.
(8) Air defense vehicles for far bank.
(9) Artillery vehicles.
(10) Smoke generator vehicles.
(11) Communication vehicles.

e. Because rafts are likely to furnish the only available means to cross the essential vehicles, they should be constructed as early as possible. However, employing men and equipment on the construction of rafts (except mobile assault rafts) may retard the building of bridges. In addition, rafts generally cannot cross a sufficient volume of combat and combat support vehicles at an acceptable rate for sustained operations. Rafts must be replaced or supplemented by bridging when enemy observation or reaction has been reduced.

f. In light of the above, the following rationale was used in selecting the optimum alternative from those shown in table X:

(1) Alternative A was rejected since it would not provide a sufficient crossing volume to allow for the timely accomplishment of the division's mission.
(2) Alternative B allows the division a maximum number of essential vehicles in the bridgehead early in the operation. It also provides a bridge which allows the division to cross a sufficient volume to accomplish its mission. However, the success of the operation now depends on the ability to prevent the enemy from destroying this one bridge. In addition, the difficulty in controlling the traffic through this "bottle-neck" so as not to present a nuclear target would be great.
(3) In this particular example, alternative C was selected as the one upon which to base the crossing plan. Alternative C provides for a sufficient volume of essential vehicles in the bridgehead early in the operation and also allows the extra advantage of one additional bridge. Using this alternative, the division does not have to hinge the success of the operation on one bridge, and the problems of traffic control is greatly simplified.

g. The crossing plan contained in the following sample operation order is based on the data developed in the preceding paragraphs.

5. Sample Operation Order

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OPORD 5
References: * * *
Task org:
* * *
Div Trp
* * *
114th Engr Gp
* * *
125th Airmbl Bn
* * *

1. SITUATION
* * *

2. MISSION
Div atks 150205 Jul; seizes crossings over DOGUE River; assumes control of and links up with 2d Bed,12th Abn Div, after its airborne assault; secures corps bridgehead in zone; and prepares to continue atk to the northeast.

3. EXECUTION
a. Concept of operation.
(1) General. This is a deliberate river crossing executed in three phases. Initiate assault crossings by assault boats and helicopters prior to first light. Sequence for operation is as follows:
(a) Phase I (H−1 to H+9):
1. H−1. Engineer elements infiltrate across river for reconnaissance and demolition missions.
2. H−15 minutes to H-hour. Artillery preparation.
3. H-hour to H+9. Amphibious assault of river line; initiate raft and bridge construction.
4. H+1. Airmobile troops arrive in vicinity of objective 4.
5. Secure line RED.
(b) Phase II (H+9—H+24):
1. H+9. Airborne unit lands vicinity of objective 8; ground units continue atk to the east.
2. Objective 8 secured by airborne unit.
3. Line WHITE seized by ground and airmobile assault.
(c) Phase III (H+24—H+60):
1. 1st Bde link up with 2d Bde, 12th Abn Div.
2. Secure line BLUE (corps bridgehead line).
(2) Maneuver.
(a) Phase I. Infiltration elements cross river, execute demolition missions, select and mark assault exits. 1st and 2d Bdes move from assembly areas in time to

begin simultaneous crossings at H-hour by assault boats. 1st Bde secures crossing areas and seizes objective 4 by airmobile and ground assault. 2d Bde secures crossing areas and seizes objective 7. Both bdes secure line RED in zone.

(b) Phase II. 2d Bde, 12th Abn Div, land in DZ's north and west of objective 8 and secure objective 8. 1st and 2d Bdes seize objectives 12 and 15 respectively, by ground and airmobile assaults and secure line WHITE in zone.

(c) Phase III. 1st Bde link up with and relieve 2d Bde, 12th Abn Div, on objective 8. 2d Bde, 12th Abn Div, revert to corps reserve on order. 2d Bde, 20th Inf Div, seize objective 13 by ground and airmobile assault. 1st and 2d Bdes secure line BLUE in zone and prep to continue atk to northeast.

(3) Fires.

(a) Air. During Phase I, air will bomb and smoke western slopes of objective 4 and 7. Throughout operation air will endeavor to gain and maintain local air superiority and will provide fighter cover for all helicopter movement throughout Phase I, II, and III, and for airhead during Phase II and III. Appendix 1 (Air Fire Plan) to ANNEX C, Fire Support Plan.

(b) Artillery. Preparation will be fired during Phase I, beginning at H−15 minutes, to neutralize enemy forces east of river and to cover final movement of assault infantry battalions from assembly areas. Fires will be planned to seal off successive lines of the bridgehead and prevent movement of enemy reserves into the area. Appendix 2 (Artillery Fire Plan) to ANNEX C, Fire Support Plan.

(c) Nuclear. No nuclear preparation will be fired. Fires will be planned to block enemy avenues of approach with priority from the east. Appendix 1 (Air Fire Plan) and Appendix 2 (Artillery Fire Plan) to ANNEX C, Fire Support Plan.

(d) ANNEX C, Fire Support Plan.

b. * * *

* * *

* * *

g. 20th Engr Bn:

(1) Support 1st Bde with two companies.

(2) Support 2d Bde with one company.

(3) Be prepared to support 3d Bde with one company when committed.

(4) Assemble and operate rafts in division zone.

(5) ANNEX D, Engineer.

h. 114th Engr Gp:

(1) Support assault with assault boats.

(2) Construct bridges.

(3) Furnish near shore engineer support. Be prepared to furnish far shore engineer support.

(4) ANNEX D, Engineer.

i. 20th Avn Bn:

(1) Support 1st Bde and 2d Bde in that order.

(2) ANNEX G, Air Movement Plan.

j. 125th Airmbl Bn:

(1) Phase I. Deliver 1st Bde force vicinity objective 4 beginning at H+1. Be prepared to support 114th Engr Gp with one medium helicopter company in movement of bridge components to river line.

(2) Phase II. Be prepared to support 1st Bde with two light helicopter companies, and 2d Bde with one light helicopter company. Be prepared to support division reserve with one light helicopter company and one medium helicopter company.

(3) Phase III. Prepare for employment northeast of line BLUE priority to 1st Bde, division reserve, 2d Bde in that order.

(4) ANNEX G, Air Movement Plan.

k. * * *

* * *

n. Coordinating instruction.

(1) ANNEX E, Crossing Plan.

(2) * * *

* * *

4. ADMINISTRATION AND LOGISTICS

* * *

5. COMMAND AND SIGNAL.

* * *

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Annexes: A—Intelligence (omitted)
B—Operation Overlay
C—Fire Support Plan (omitted)
D—Engineer (omitted)
E—Crossing Plan
F—Road Movement Plan (omitted)
G—Air Movement Plan (omitted)
H—Signal (omitted)

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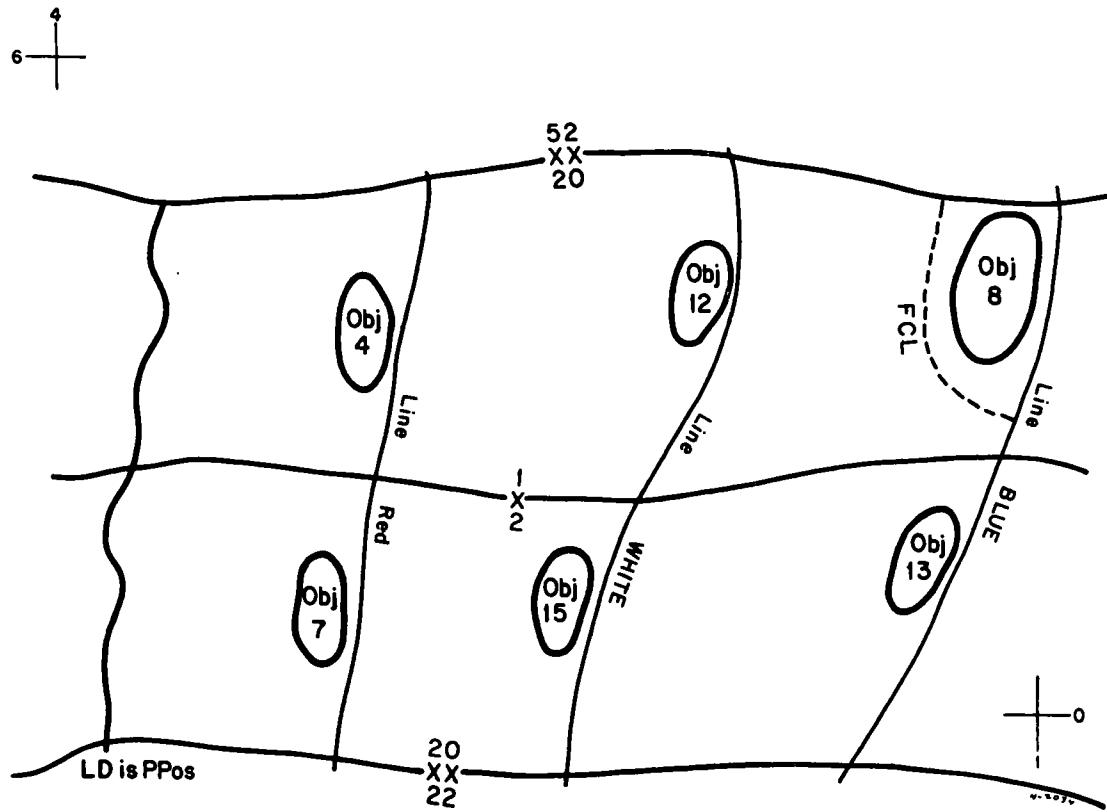

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Annex B (Op Overlay) to OPORD 5.

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ANNEX E (Crossing Plan) to OPORD 5
References: * * *

1. CROSSING SITE LOCATIONS.
Appendix 1, Assault Crossing, Raft and Bridge Sites Overlay.

2. ASSAULT CROSSINGS.
a. 1st Bde.
(1) Crossing area OREGON: assault crossing sites 2 and 3.
(2) Crossing area VERMONT: assault crossing sites 5, 7 and 8.
b. 2d Bde.
(1) Crossing area TEXAS: assault crossing sites 10 and 11.
(2) Crossing area FLORIDA: assault crossing site 13.
c. 1st Recon Sqdn, 21st Cav. Crossing area OREGON: assault crossing site 2 on order.

3. RAFT SITES
For type and capacity of LTR's and Mobile Assault Rafts and priority of crossing see appendix 2 (Raft Data and Priority of Crossing).

4. FLOATING BRIDGES
a. Type and capacity of bridges in 20th Inf Div zone:

CROSSING AREA	SITE	TYPE BRIDGE	CL	APPROX OPENING TIME
OREGON	ECHO	M4T6	45/55	H+6
TEXAS	QUEBEC	M4T6	45/55	H+6
FLORIDA	WHISKEY	ALUM FOOT BRIDGE	Foot	H+2

b. Tentative priority of crossings:
(1) Site ECHO
H+6 to H+6 hr 15 min ..... Div Trp
H+6 hr 15 min to H+8 hr 15 min ..... 1st Bde
H+8 hr 15 min to H+9 hr 45 min ..... 3d Bde
H+9 hr 45 min to H+10 ..... Div Trp
H+10 to H+11 ..... Spt Comd
(2) Site QUEBEC
H+6 to H+6 hr 15 min ..... Div trp
H+6 hr 15 min to H+7 hr 30 min ..... 2d Bde
H+7 hr 30 min to H+9 ..... Div Arty
H+9 to H+11 ..... Div Trp
(3) Site WHISKEY
H+2 to H+11 ..... 2d Bde

5. CONTROL OF CROSSING

a. Division traffic headquarters controls all crossings in division zone except assault crossings and traffic within the four crossing areas. The following officers are designated crossing area commanders for the indicated areas:

CROSSING AREA	COMMANDER	CP LOCATION
OREGON	Brig Gen BLACK, ADC, 20th Inf Div	FS4448
VERMONT	Lt Col GREEN, XO, 3d Bde, 20th Inf Div	FS4331
TEXAS	Brig Gen BLUE, ADC, 20th Inf Div	FS4212
FLORIDA	Lt Col BROWN, Div HHC, 20th Inf Div	FS4204

b. All raft and bridge crossing priorities will be adjusted based on actual opening times of rafts and bridges.

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Appendix: 1—Assault Crossing, Raft and Bridge Sites
2—Raft Data and Priority of Crossing

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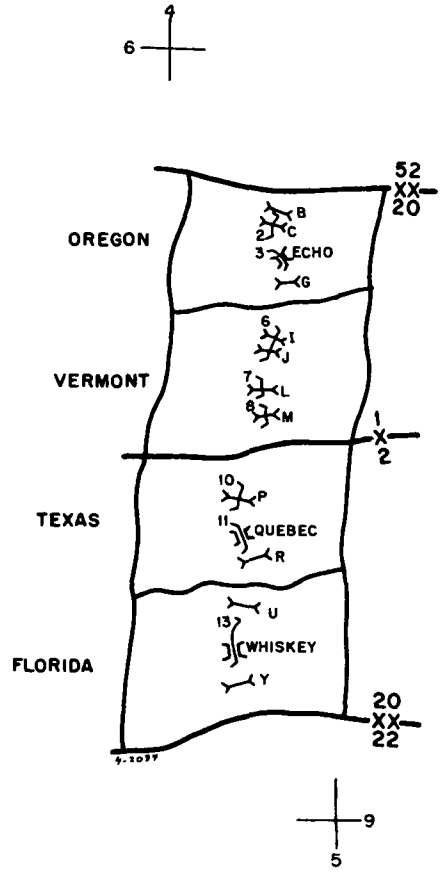

LEGEND OF SITES

] Assault Crossing

Raft

)(Bridge

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APPENDIX 1 (Assault Crossing, raft and bridge sites overlay) to Annex E (Crossing Plan) to OPORD 5.

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Appendix 2 (Raft Data and Priority of Crossing) to ANNEX E (Crossing Plan to OPORD 5).

1. Type and capacity of LTR's and Mobile Assault Rafts in zone of 1st Bde.

CROSSING AREA	SITE	NO. AND TYPE RAFT	OPENING TIME (APPROX)	ROUND TRIPS EA HOUR PER RAFT	CAPACITY PER HR (DAY) TANK G.P.	VEH	CAPACITY PER HR (NIGHT) TANK G.P.	VEH
	B	1—LTR	H+1 hr 30 min	7	--	7	--	3
OREGON	C	1—Mbl Aslt	H+2 hr	7	14	(28)	6	(12)
	G	2—LTR	H+1 hr 30 min	7	--	14	--	6
	TOTAL capacity per hour, Mobile Aslt Raft				14	(28)	6	(12)
	TOTAL capacity per hour, LTR				--	21	--	9
	I	1—Mbl Aslt	H+2 hr	7	14	(28)	6	(12)
VERMONT	J	1—LTR	H+1 hr 30 min	7	--	7	--	3
	L	1—Mbl Aslt	H+1 hr 30 min	7	14	(28)	6	(12)
	M	1—LTR	H+1 hr 30 min	7	--	7	--	3
	TOTAL capacity per hour, Mobile Aslt Raft				28	(56)	12	(24)
	TOTAL capacity per hour, LTR				--	14	--	6

2. Type and capacity of LTR's and Mobile Assault Rafts in zone of 2d Bde.

CROSSING AREA	SITE	NO. AND TYPE RAFT	OPENING TIME (APPROX)	ROUND TRIPS EA HOUR PER RAFT	CAPACITY PER HR (DAY) TANK G.P.	VEH	CAPACITY PER HR (NIGHT) TANK G.P.	VEH
TEXAS	P	1—LTR	H+1 hr 30 min	7	--	7	--	3
	R	1—LTR	H+1 hr 30 min	7	--	7	--	3
	TOTAL capacity per hour, Mobile Aslt Raft				--	14	--	6
FLORIDA	U	1—Mbl Aslt	H+2 hr	7	14	(28)	6	(12)
	Y	1—LTR	H+1 hr 30 min	7	--	7	--	3
	TOTAL capacity per hour, Mobile Aslt Raft				14	(28)	6	(12)
	TOTAL capacity per hour, LTR				--	7	--	3

NOTE: Figures in parentheses indicate vehicle capability when heavy rafts are not being used for tanks or special vehicles.

3. Tentative priority of raft sites. Bdes plan crossing of DS Arty.

SITE	TIME PERIOD	UNIT
B	H+1 hr 30 min - H+6	1st Bde
	H+6 - H+11	Div Trp
C	H+2 - H+5	1st Bde
	H+5 - H+11	Div Trp
G	H+1 hr 30 min - H+9	1st Bde
	H+9 - H+11	Spt Comd
I	H+2 - H+9	1st Bde
	H+9 - H+11	Spt Comd
J	H+1 hr 30 min - H+9	1st Bde
	H+9 - H+11	Div Trp
L	H+2 - H+4	1st Bde
	H+4 - H+11	Div Arty
M	H+1 hr 30 min - H+4	1st Bde
	H+4 - H+11	Div Arty
P	H+1 hr 30 min - H+9	2d Bde
	H+9 - H+11	Div Trp
R	H+1 hr 30 min - H+5	2d Bde
	H+5 - H+11	Div Arty
U	H+2 - H+7	2d Bde
	H+7 H+11	Div Arty
Y	H+1 hr 30 min - H+9	2d Bde
	H+9 - H+11	Div Trp

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USAES (15)
USASA Sch (5)
USAINTS (10)
MFSS (5)
USA Ord Sch (20)
PMGS (25)
USAQMS (10)
USATSCH (5)
USACAS (50)
USASWS (2)
Joint Sch (5)
USACAG (5)
USACSSG (1)
USASDEG (1)
MDW (3)

NG: None.
USAR: Units—same as active Army.
For explanation of abbreviations used, see AR 320-50.

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Table III. Rafts (Superseded)

1.	1 Type of raft	2 No of pontons or floats	3 Length (meters) Overall incl ramps	3 Length (meters) Available for loading[1]	4 Construction time (min)[2]	5 Construction party	6 Operating crew	7 Class and number of power units needed[3] — Normal crossing — Stream velocity (meters per second) 1	1.6	2.3	3	7 Risk crossing — Stream velocity (meters per second) 1	1.6	2.3	3	8 Type of power unit required	9 Transportation required (For raft equipment only. Additional needed for const equip and trps) No units	Unit
2.	Light Tactical Raft with articulators	4 (3 bay)	14.6	9.1	30	1 Plat	1 Squad and ontboard operators	12/1	12/1	12/2	8/3	20/1	20/1	20/2	12/3	25 bp outboard motor[10]	2	2½-ton cargo truck with 2½-ton pole trailer
		5 (5 bay)	21.3	15.5	35			9/1	9/1	9/2	8/3	19/1	19/1	17/2	12/3		2	
		6 (5 bay)	21.3	15.5	40			13/1	13/1	13/2	18/4	22/1	22/1	22/2	22/4		2	
3.	Clasa 60	4 Normal	28.2	15.5	[6]70 [7]30	1 Plat[6,7]	1 Squad and power unit operators	40/45/1	40/45/1	40/45/2	35/40/2	50/55/1	50/55/1	50/55/2	45/50/3	27-ft bridge erection boat[8]	5	5-ton bridge truck
		5 Reinf	28.2	15.5	[6]80 [7]35			55/60/1	55/60/1	50/55/2	45/50/4	60/70/1	60/70/1	60/65/2	55/60/4		6	
		6 Reinf	28.2	16.5	[6]90 [7]50			65/75/1	65/75/1	65/75/2	60/65/4	80/90/1	80/90/1	80/90/2	70/80/4		6	
4.	M4[4,5] (limited standard)	4	26.5	15.7	[6]70	1 Plat	1 Squad and power unit operators	50/55/1	50/55/1	50/55/1	50/55/1	55/60/1	55/60/1	55/60/1	55/60/1	27-ft bridge erection boat[8]	5	2½-ton bolater truck with 2½-ton bolster trailer
		6 Reinf	26.5	15.7	[6]80			70/75/1	70/75/1	70/75/1	65/70/2	75/80/1	75/80/1	75/80/1	75/80/2		6	
		7 Reinf	26.5	15.7	[6]85			85/90/1	85/90/1	85/90/1	80/85/3	90/95/1	90/95/1	90/95/1	90/95/3		7	
5.	M4T6[4]	4	26.5	15.7	90	1 Plat	1 Squad and power unit operators	50/55/1	50/55/1	45/50/2	35/40/3	60/65/1	60/65/1	55/60/2	45/50/3	27-ft bridge erection boat[8]	5	5-ton bridge truck
		5 Reinf	27.1	15.3	100			60/60/1	60/60/1	60/60/2	50/60/3	75/75/1	70/75/1	70/75/2	65/70/3		6	
6.	Amphibious Mobile Assault Raft	2	32.0	17.2	15	None[9]	1 Man and amphibious vehicle crews	45/50	45/50	40/45	30/35	55/60	55/60	48/53	40/45	Self contained power in amphibious bridging units	2	Amphibious bridge vehicles plus 2 amphibious ramp carriers or 1 5-ton tractor with 25-ton low bed trailer
		3	40.0	25.2	20	None[9]		60/65/90	60/65/90	55/60/90	40/45	70/75/90	70/75/90	63/68/90	50/55		3	
		4	48.0	33.2	25	None[9]		60/65/120	60/65/120	55/60/120	45/50	73/78/120	73/78/120	67/72/120	60/65		4	

Operating characteristics of rafts	Stream width (meters) 75	150	300
No of round trips per br in currents of 1.6 mps in daylight (reduce 50 percent for night or adverse conditions)			
Light Tactical Raft	8	6	4
Class 60	6	4	2
M4T6	8	6	4
Amphibious Mobile Assault Raft	8	6	4
No. of rafts which can be used efficiently at one time	1	2	3

[1] Measured from outside edge to outside edge of end pontons or float saddle beams, except mobile assault ferry which is measured from ramp joint to ramp joint.

[2] Construction time includes unloading and assembly only, does not include preparation of landing sites or construction of access roads. Times are based on use of trained personnel and no delays.

[3] Capacities are based on loading rafts with center of gravity of loads 6 inches downstream of raft centerline and on properly inflated floats, or conversion from highway travel condition to water entry configuration for mobile assault ferry.

[4] Roadway width consists of 18 balk between curbs in 22 balk deck.

[5] Extreme caution is required in loading and unloading vehicles weighing more than 60 tons.

[6] Truck-crane or equivalent required for assembly time.

[7] Complete bays preassembled in rear area and launched directly from transporting trailer into water at assembly site.

[8] One 19-ft bridge erection boat may be used in current not over 1.6 mps. In 1.6 mps currents and over, two 19-ft boats may be substituted for one 27-ft boat.

[9] Exclusive of amphibious vehicle crews.

[10] 27-ft erection boat may be used when pusher connector is lashed to pontons.

KEY

Capacity class wheeled vehicles
Capacity class tracked vehicles
No. of power units needed to propel rafts across indicated currents.

Capacity class wheeled vehicles
Capacity class tracked vehicles
Double vehicle capacity (approx. equal in weight).

Table IV. Float Bridges (Superseded)

1.	1 Type of bridge		2 Transportation required[1]	3 Construction Party[2]/Construction Time[3] (hours) Stream width (meters) Up to 80	80–160	160–325	4 Maint crew (No men)	5 Load classes[4] — Safe crossing (posted capacity)[5] — Stream velocities in meters per second (mps) 1	1.6	2.3	2.6	3	3.6	Caution crossing[6] 1	1.6	2.3	2.6	3	3.6	Risk crossing[7] 1	1.6	2.3	2.6	3	3.6	6 Traffic capacity and vehicular distance for safe crossing in daylight (except as otherwise noted)[8]
2.	Footbridge, aluminum		1 2½-ton truck and 1 2½-ton pole trailer per 77.4 meters of bridge	1 Plat ⅓–½	1 Plat ½–⅚	---	1 Sqd	◄—Safe—►						---	---	---	---	---	---	---	---	---	---	---	---	Day: 75 men per min Night: 40 men per min at 2-pace distance.[9]
3.	Ligbt tactical bridges		2 2½-ton truck and 1 2½-ton pole trailer per 14.4 meters of bridge	1 Plat 1–1½	2 Plat 1½–2½	---	1 Sqd	16	16	13	11	8	2	18	18	15	12	9	3	21	21	17	14	11	5	400 vehicles per hr 30 meters distance between vehicles.
4.	M4T6[10] float bridge	Normal	1 5-ton truck per 4.9 meters of bridge.	1 Co 2–3	2 Co 3–5	2 Co to 1 Bn 5–10	1 Sqd	50/55	45/55	40/50	35/45	30/40	25/30	60/61	58/59	54/55	49/51	45/47	35/37	68/69	66/67	62/63	59/60	54/56	43/45	400 vehicles per hr
		Reinforced	1 5-ton truck per 3.3 meters of bridge.					75	75	70/75	65/70	55/60	27/30	80	80	79	73	66/67	43/45	90	90	90	87	81	59/60	30 meters distance between vehicles.
5.	Class 60 floating bridge	Normal	1 5-ton bridge truck per 4.9 meters of briidge.	1 Co 2–3	2 Co 3–5	2 Co to 1 Bn 5–10	1 Sqd to 1 Plat[14]	60/65	55/65	11 45/55	40/50	35/45	22/25	65/70	62/67	56/61	52/56	45/49	34/37	75/79	72/77	67/72	62/67	57/62	46/50	400 vehicles per hr 30 meters distance between vehicles.
		Reinforced	1 5-ton bridge truck per 4.9 meters of bridge.	1 Co 3–4	2 Co 4–7	2 Co to 1 Bn 7–12		65	65	65	65	65	30/35	75	75	75	75	75	47/51	85	85	85	85	85	70/74	
6.	M4 floating bridge (limited standard)	Normal[12]	1 2½-ton bolster truck and 1 2½-ton bolster trailer per 4.9 meters of bridge.	1 Co 2–3	2 Co 3–5	2 Co to 1 Bn 5–10	1 Sqd to 1 Plat[14]	60	60	45/50	45	30/35	18/20	68	65	58/59	52/53	44/46	29/31	72	68	61/62	58/59	53/54	37/39	
		Reinforced[13]	1 2½-ton bolster truck and 1 2½-ton bolster trailer per 3.3 meters of bridge.	1 Co 3–4	2 Co 4–7	2 Co to 1 Bn 7–12		95	95	75/80	60/65	45/50	24/27	100	100/99	88/85	75/74	62	35/37	105/100	105/100	101/96	88/85	74/73	45/46	
7.	Amphibious mobile assault bridge		1 Amph brg veh per 8.0 meters of brg exclusive of 8.0 meters ramp at each end of brg & 2 amph ramp carriers or 1 5T tractor w/25 ton low bed tlr.	Note 15 ½–⅔	Note 15 ⅔–1	Note 15 1–2	Note 15	60/65	60/65	55/60	50/55	45/50	25/30	65/70	65/70	60/65	55/60	50/55	35/40	73/78	73/78	67/72	65/70	60/65	45/50	400 vehicles per hour 30 meters distance between vehicles.

[1] Transportation for bridge equipment only. Additional needed for any construction equipment required, and for troops.

[2] Average for trained troops and continuous daylight assembly. Allowances are required for specific situations and the longer spans.

[3] Includes unloading and assembly only in daylight. Does not include access roads, assembly sites, abutments, or anchorages. Does not include conversion from highway travel condition to water entry configuration for the mobile assault bridge units. Time is based on use of trained troops and no delays. Average time with 2 assembly sites.

[4] Based on abutments at levels within 12-in of floating bridge deck level.

[5] Vehicle anywhere on bridge deck between curbs. Speeds up to 40 kph permitted, but 24 kph recommended. Vehicle spacing, 30 meters.

[6] Center of vehicle within 12 in of bridge centerline. Maximum speed 13 kph. Vehicle spacing 50 meters. No stopping, accelerating, or gear shifting.

[7] Center of vehicle within 9 in of bridge centerline with guide. Maximum speed 5 kph. One vehicle on bridge. No stopping, accelerating, or gear shifting.

[8] Traffic capacities are for all traffic moving forward or rearward.

[9] Reduce capacity 20 percent for currents of 3 to 3.6 mps.

[10] Ratings based on 18 balk curbs (166⅔ in) in 22 balk wide superstructure.

[11] 60-ton tanks having tread widths of 143 inches or more may cross safely up to 2.3 mps.

[12] Ratings based on use of reinforcing ponton in end span and 18 balk between curbs (166⅔ in) in 22 balk wide superstructure.

[13] Ratings based on use of double deck end span, 100 percent reinforced floating section and 20 balk between curbs (185 in) in 24 balk wide superstructure.

[14] Depending on length of bridge and general conditions.

[15] Only MAB crews are required, plus bank and access road preparation as needed.

KEY

Class for wheeled and tracked vehicles
Class for wheeled vehicles
Class for tracked vehicles

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Table III.

Table IV.

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